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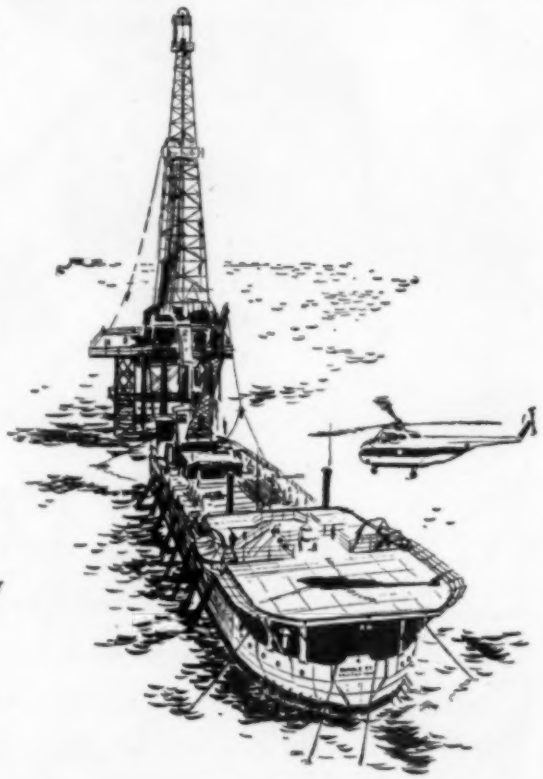
United Airgram

UNITED AIRCRAFT EXPORT CORPORATION

SIKORSKY S-55 HELICOPTERS SPEED DEVELOPMENT OF OFF-SHORE OIL WELLS

Sikorsky S-55 helicopters once again are demonstrating their efficiency and rugged dependability in commercial service, this time by providing over-water transportation for oil well drilling crews who work far out in the Gulf of Mexico.

In a pioneering operation which began last spring, big Sikorskys have been used in daily scheduled service to solve various difficult transportation problems encountered in off-shore oil development work. This operation centered along the continental shelf which parallels the U.S. coastline, off Texas and Louisiana. Here some drilling sites are now as far as 45 miles from supply bases, and located in waters as deep as 100 feet. Seas are often rough. Transportation by boat is slow, frequently hazardous, and always uncomfortable for workmen susceptible to seasickness. Helicopters offered solutions to these problems of boat transportation.



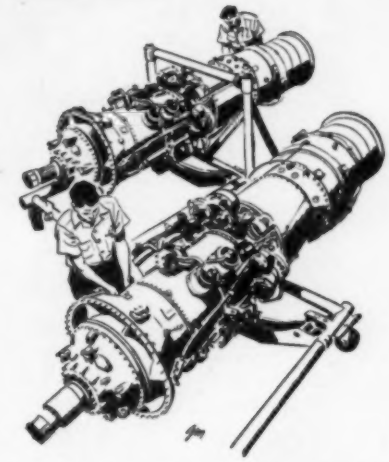
The initial demonstration of helicopter use for crew transportation was the operation of services for one major company, between Grand Isle, on the mainland, and one area off Louisiana. The flying service was provided by Petroleum Helicopters, Inc. of New Orleans. Using big S-55s, this firm handled a steady flow of workmen - as many as 110 per day - between the mainland and a number of drilling platforms or floating tenders on which landing decks were built for the helicopters.

Success was immediate. The helicopters were able to operate in nearly every kind of weather. Crews reached the job in 30 minutes instead of many tiresome hours. Seasickness and many safety hazards were eliminated. The helicopters were able to provide fast ambulance service in case of illness or accident. They eliminated the need for many costly boats once required for both transportation and emergency standbys.

Currently, plans are being made for extension of helicopter transportation to a large number of off-shore drilling and production operations. Almost all drilling platforms now under construction, and most drilling tenders, are being equipped with platforms on which the big Sikorskys can land and takeoff.

NEW DOUGLAS TRANSPORT TO HAVE PRATT & WHITNEY AIRCRAFT T-34

Pratt & Whitney Aircraft's 5700 h. p. T-34 turboprop engines will power the new Douglas C-133A, a giant transport aircraft to be built for the U. S. Air Force.



Prototype of the four-engine plane is now under construction at the Douglas plant in Long Beach, California. Flight is anticipated in mid-1955.

Specifications of the new transport are still confidential. It is known, however, that the C-133A will be larger than the Douglas YC-124B Globemaster II. This aircraft is the largest regular production military transport now in service.

Power plant package for the C-133A was evolved from the YC-124B engine installation. The YC-124B is a Globemaster II redesigned for four P&WA T-34 turboprop engines. Normally, the Globemaster is powered by four 3800 h.p. P&WA R-4360 piston engines.

A limited T-34 production program at Pratt & Whitney Aircraft is now supplying turboprop engines for the YC-124B, for Air Force and Navy turboprop versions of the Lockheed Super Constellation, designated the C-121F and the R7V-2 respectively, and for Boeing C-97J Air Force turboprop Stratofreighters.

NEW HAMILTON STANDARD PNEUMATICS LABORATORY LAUNCHES BOMBER SYSTEM TESTS

An extensive addition to Hamilton Standard's advanced pneumatics laboratories at Windsor Locks, Connecticut, has been opened with a new job: testing a Hamilton Standard air conditioning and pressurization system being developed for a still-secret supersonic military bomber.

The recently completed addition houses highly specialized test equipment, much of which is completely new to the division's development laboratories. The facilities reflect the growing performance required of aircraft equipment today, and the division's anticipation of future aircraft requirements.

New test equipment includes a sand and dust chamber, a shock test rig, a centrifuge device to simulate the forces imposed on equipment in high speed turns and pull-outs, and a simulated jet aircraft cockpit. Other equipment installed in the new facility includes four test booths for air conditioners, five valve test rigs, an altitude chamber, a salt spray test chamber, and an electronic vibration machine for fatigue testing air conditioning equipment. New also is an enviromental chamber, where the climate of any place in the world can be simulated.

The new test facilities augment one of America's outstanding experimental test areas. Now in operation, in addition to the pneumatics laboratory, are propeller and jet engine test cells, laboratories for fuel controls, hydraulics, mechanical tests, vibration and electronics, a propeller balancing room, and a separate building housing a combustion laboratory.

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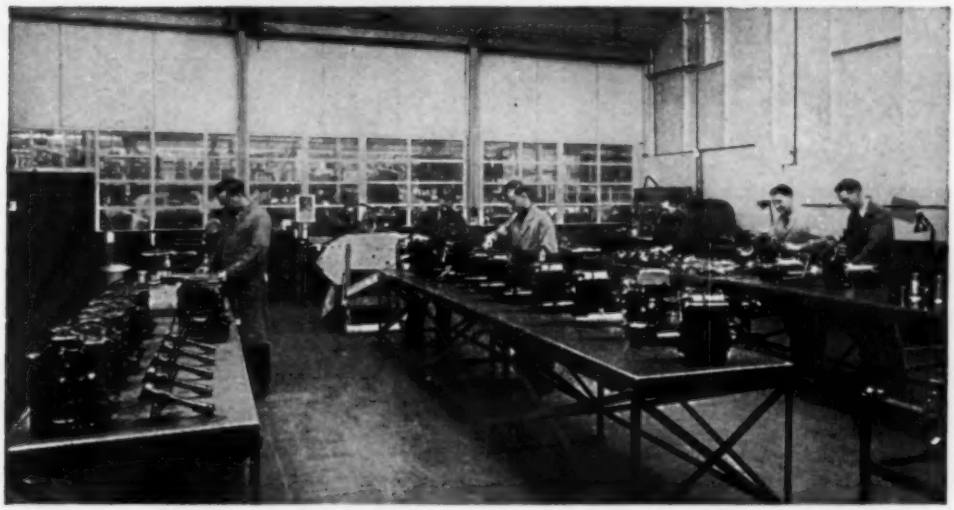

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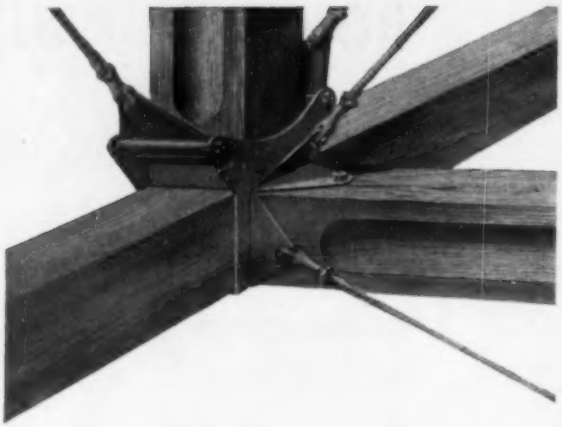
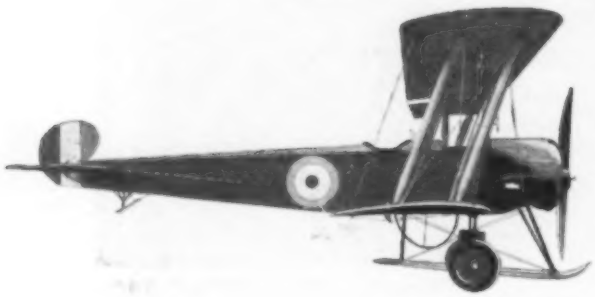
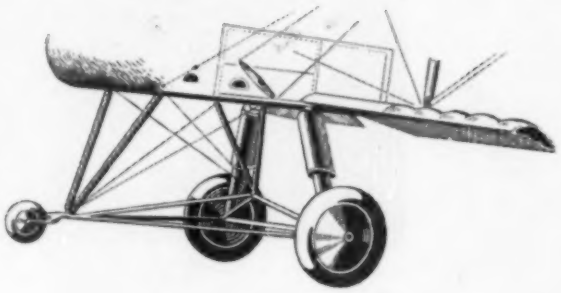


Gone, but not forgotten





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The one major obstacle to the much-needed change to Constant Frequency A.C. Systems in the air—the problem of satisfactory operation of alternators in parallel—has been overcome by the introduction, by ENGLISH ELECTRIC, of the Sundstrand Constant Speed Alternator Drive.

This Drive, in full and increasing production in the U.S.A. for several years, is in regular squadron service in the United States Air Force.

Now ENGLISH ELECTRIC, by manufacturing the Drive under licence in this country, are to add their own unrivalled experience in the design and engineering of A.C. power systems to the development work and production know-how of the Sundstrand Machine Tool Co. No organisation in this country has wider experience than ENGLISH ELECTRIC in the design and construction of all the component parts of constant frequency A.C. systems—alternators, transformers, switchgear, motors, etc.

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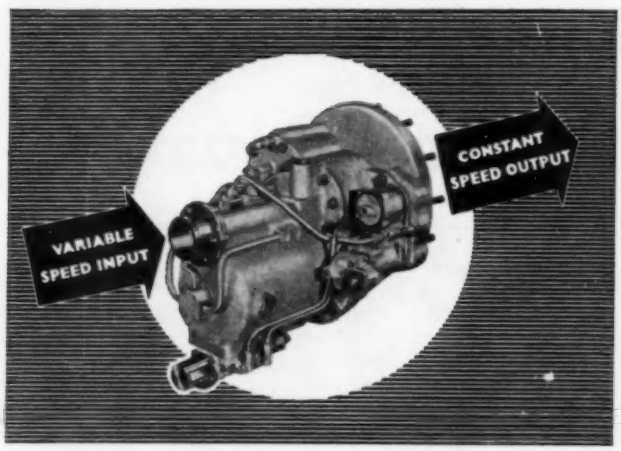

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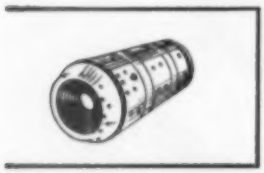

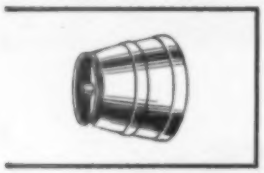

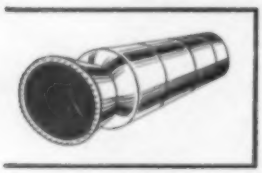

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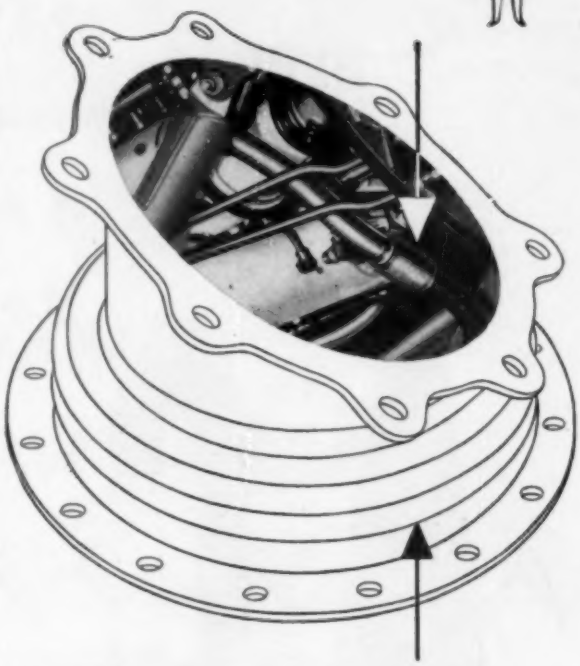

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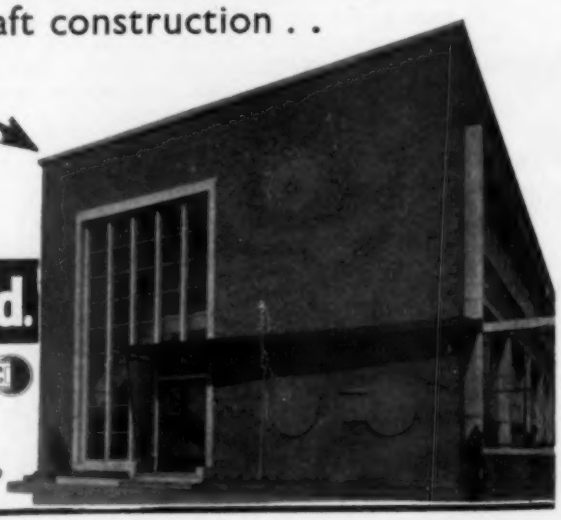

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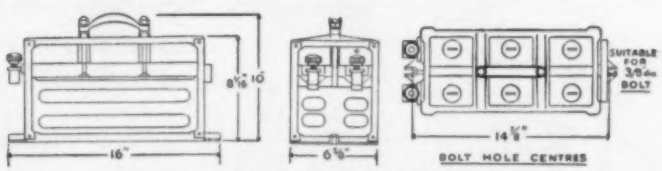

Side and end views of 6-EP19B/2 with battery layout diagram

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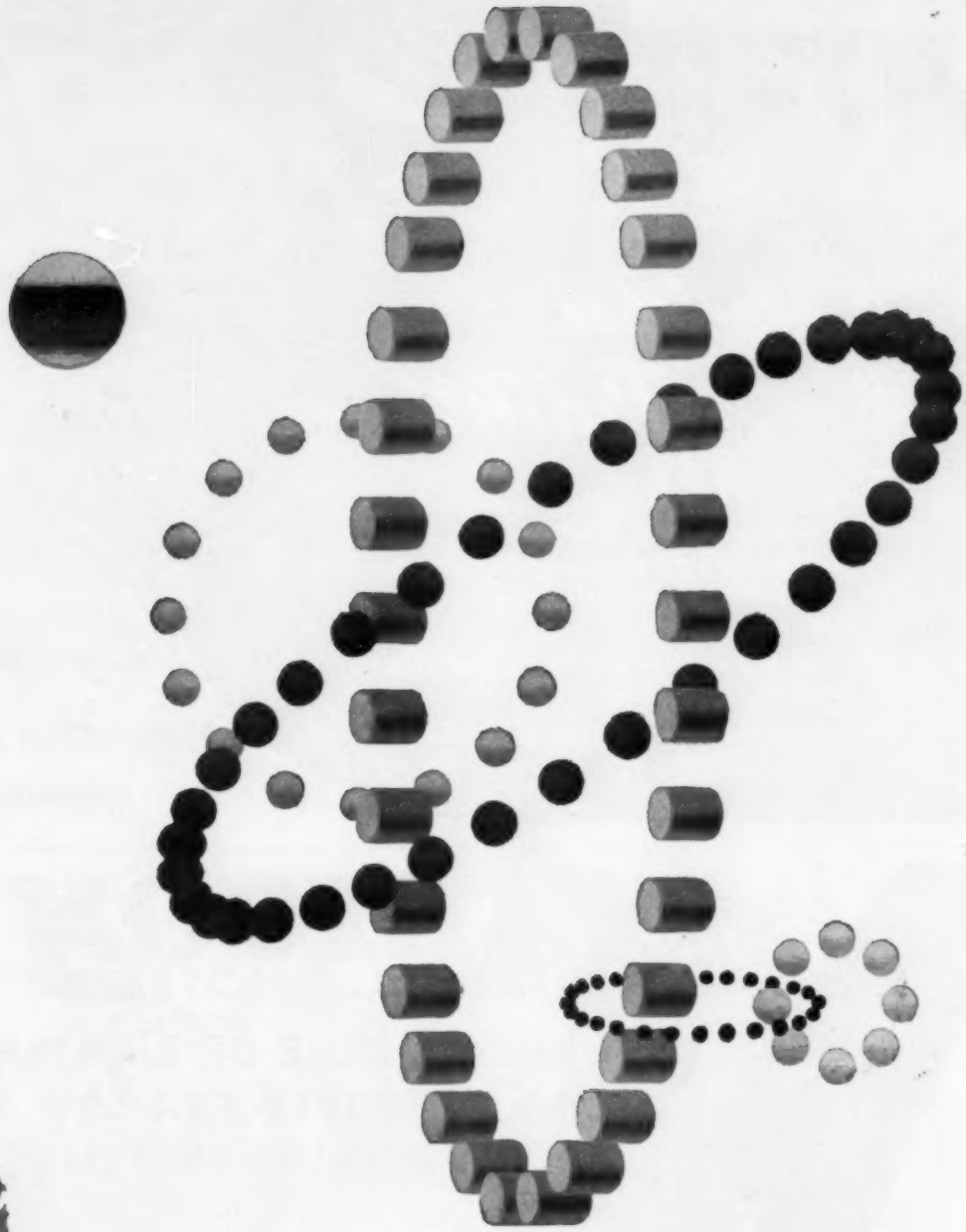

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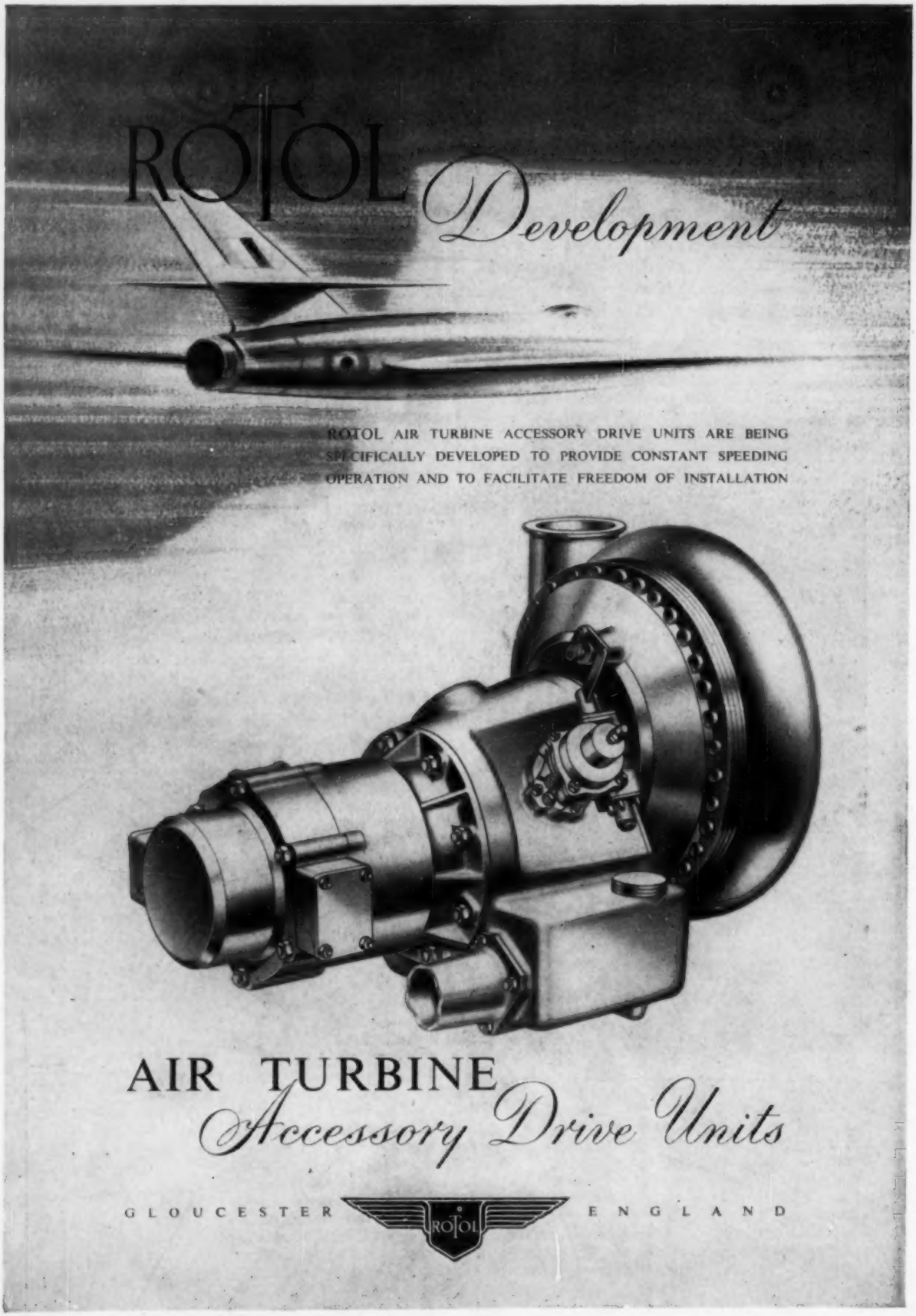
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Sinking Differences

SEVERAL aviation battles are being (or seem likely to be) waged this winter; some are new and others have been resurrected. For example, the ultimate control of R.A.F. Coastal Command may, we hear, come in for a lot more discussion with the appointment of the new Fifth Sea Lord. Again, with the abandonment of heavy ack ack guns the control by the R.A.F. of the missiles which are to succeed them may in some quarters be questioned. The Army's air mobility is another matter which must be subject to important changes and developments in the coming months and years, and here again the right to control and operate the aircraft may be contested between the Services. The recent decision to form a joint R.A.F./Army helicopter school for the Army—possibly the result of a compromise—will also have been noted. In a slightly different field, the training and provision of test pilots, and the point at which the R.A.F. or Navy start to take a practical interest in the development flying of the machines they have ordered, may give cause for some hard thinking.

There seems to be a definite pattern running through these matters which directly reflects the growing significance of the Royal Air Force—already the most important of the three Services—and at the same time implies a dwindling usefulness and scope of the traditional weapons and activities of the other two.

By reason of a thorough airing of opinions and some hard bargaining, controversies of this kind can often lead to the best possible solutions. On the other hand, over-long delays when it is known that a change is coming can also lead to uncertainty and unrest among the numerous people who will be affected, something obviously to be avoided. Again, if the real issues become subordinated and the conflict becomes one of personalities and politics, the worst is to be feared. The moral scarcely needs pointing out.

Foundations for Rotorbus Services

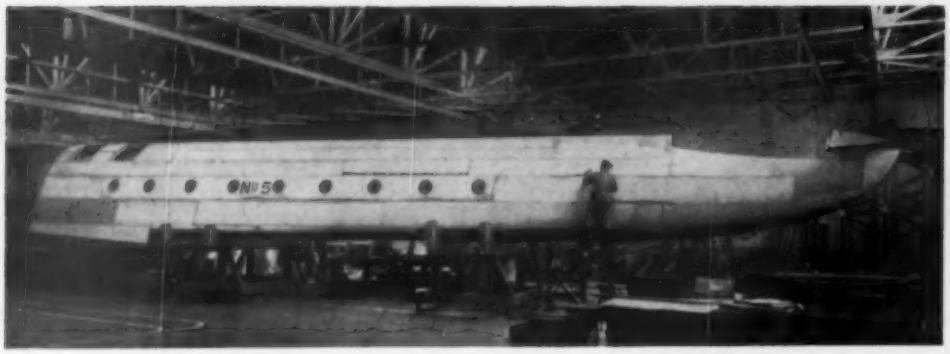
THERE is still plenty of sense in the old adage about not crossing bridges in advance of one's arrival at them; but, equally, it is a dull scout or foolish virgin who is caught unprepared. These profound thoughts arise from pronouncements by men actively concerned with commercial helicopter operations, present and expected, and from our own apprehension regarding the adequacy of preparations for these aircraft.

A few weeks ago the Under-Secretary for Civil Aviation assured the House of Commons that the Minister would see to it that the introduction of scheduled helicopter services was not delayed by the lack of suitable landing sites. We should feel happier if there were more indication that the ways as well as the will were there.

Suitable and acceptable sites for airstops will not be easy to find in the cities of England; and, when they have been found, the negotiations for their use and their preparation and equipment will not be accomplished overnight. We feel, in fact, that it would not be too soon to be selecting sites now, so that they will be unencumbered and ready for development in a year or two's time. In this connection we would recall a recent contribution from the City Engineer and Surveyor of Liverpool. He said: "The erection of an elevated landing ground serving no other purpose is far too costly. . . . A central airstop should be a strengthened roof of a building or group of buildings, and they should be as tall as possible so that the expense of roof strengthening would be but a small proportion of the cost of the main structure."

Although for a start only a few of the larger cities can expect to have helicopter services, it would be stupid not to prepare for the large network of routes which will certainly develop over these islands and the continent of Europe. Frequency and volume of services and the number of other centres served will be main factors in the popularity and financial success of such operations. Rotorbus services should eventually be run with the same lack of formalities as motor 'bus services, not in grandiose airline style.

This much said about an early stage, we may fittingly quote from a Sabena spokesman (whose company already, of course, operates international helicopter services) about a later one. He stated at a recent international conference: "We must not accept fixed-wing answers to helicopter questions. Regulations for helicopter operations should not become rigidly fixed before experience proves their need."



THE TAIL BOOM of the Blackburn and General Beverley C.1 military freighter is bigger than a DC-3 fuselage and can seat 42 in comfort. These views show a production rear fuselage in the company's factory near Hull, one photograph (foot of opposite page) illustrating the unobstructed interior, which measures 39ft by 8ft by 6ft high.

FROM ALL QUARTERS

A New Olympus

THE existence of another new mark of Bristol Olympus was announced earlier this week; it is designated BOl.6. The only unit of this basic type for which a power rating has been released is the BOl.1 of 9,750 lb thrust. This figure was achieved more than two years ago, so it may safely be assumed that both the BO1.6 and an intermediate unit being produced for the Avro Vulcan (and undergoing a type-test at the present time) have outputs substantially in excess of 10,000 lb.

Like its predecessors, this latest Olympus is intended for fighter applications as well as for larger aircraft.

Thunderstreaks at Bentwaters

THAT the primary mission of the 81st Fighter-Bomber Wing U.S.A.F.E., based at Bentwaters, Suffolk, and now equipped with the Republic F-84F Thunderstreak (Wright J65 Sapphire) is to conduct atomic operations against aggressor forces in Europe in support of NATO was confirmed at a Press day last Friday.

The Wing's secondary mission is to assist as required in the defence of the United Kingdom. Thunderstreaks made low runs at speeds up to 720 m.p.h. and demonstrated assisted take-off, using a 4 × 4,000 lb installation. It was learned that the Mach limitation in service is 1.175 and that M = 0.9 to 0.94 is permissible with external tanks (according to type). Ferry range is "well over 2,000 miles."

A report of the demonstration, and new facts concerning the Thunderstreak, will appear in our next issue.

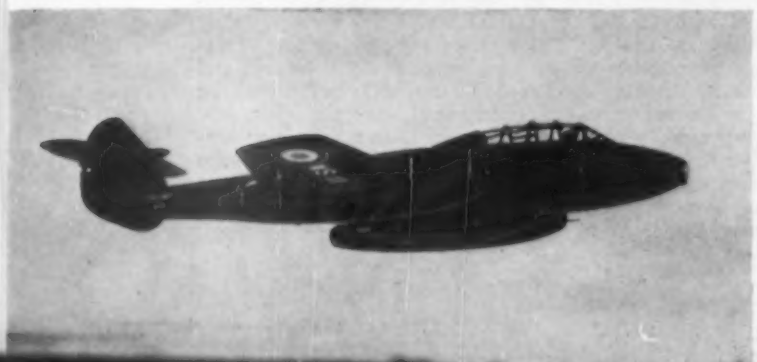
D.H.110 Excels in Attack

DURING recent test flying, the de Havilland D.H.110, which is under development for the Royal Navy as a carrier-based all-weather fighter, has achieved outstanding attack dive speeds, well above the speed of sound. Moreover, this exceptional Machworthiness is accompanied by excellent control characteristics (it has a flying tail), and it would seem that this aircraft could be used as a gun-platform throughout the transonic regime, and beyond.

Most of the development flying of this twin-Avon two-seater is being done by Mr. John Wilson. So far only two more prototypes are being built at Christchurch: one with a hook, and another fully "navalized" machine with folding wings as well.

Helicopter Simulators

LAST Friday a most interesting lecture and discussion meeting were held by the Helicopter Association, the subject being *The Possibility of the Flight Simulator as a Training Aid to Helicopter Pilots*. The introduction was by Mr. Norman Hill, who first discussed flight simulators for fixed-wing aircraft. A short film was then shown, depicting a training session in a B.O.A.C. Comet simulator. Mr. Hill's contribution was followed by a paper by M. P. de Guillenchmidt, managing director of Giravions Dorand of France.



Rotodyne Loads

IT can now be disclosed that the engines of the Fairey Rotodyne, classified by the Ministry of Supply as an "experimental helicopter," are two Napier Eland NEl.3s. Two prototypes are under construction, the second (according to a recent pronouncement by Sir Richard Fairey) having a fuselage with "somewhat different internal arrangement."

Typical loads announced by the manufacturers are: 45 passengers and baggage; 40 troops and equipment; 30 stretchers and 10 attendants; 11,000 lb of freight; 100 sacks of fertilizer; 3 cars and 12 passengers; 2 Daimler ambulances; Continental touring coach and passengers; Hunter fighter minus engine, and with wings removed; scout car and 1 ton of ammunition; jeep and 25-pounder gun; 2 one-ton lorries; 300 lambs or 150 sheep or 20 cattle (alive or as carcases); 11,000 lb or 3,300 cu ft of mail in sacks; 4,000 cans of beer or milk; 4 ultra-light helicopters.

The fuselage cross-section (particularly the headroom) could be increased as required to take loads such as a three-ton Army lorry.

By-Pass Running Time

IT was announced by Rolls-Royce last week that the total running time of the Rolls-Royce Conway is now nearly one thousand hours. There is no doubt that this is a most impressive figure, for the development of a by-pass turbojet on the scale of the Conway —it is described by the company as "one of the most powerful engines in the world"—is probably the most difficult assignment that any gas-turbine firm could undertake.

No specific history of the Conway may yet be published, although the name certainly embraces a whole family of engines (the RCo.5 was named recently), all of which differ from one another to a greater, or lesser, degree. The only application of the engine so far announced is in the Vickers-Armstrongs 1000, and we understand that when this aircraft flies next autumn it will, in fact, do so on the thrust of four Conways. The thrust requirement for this aircraft cannot be far short of 60,000 lb.

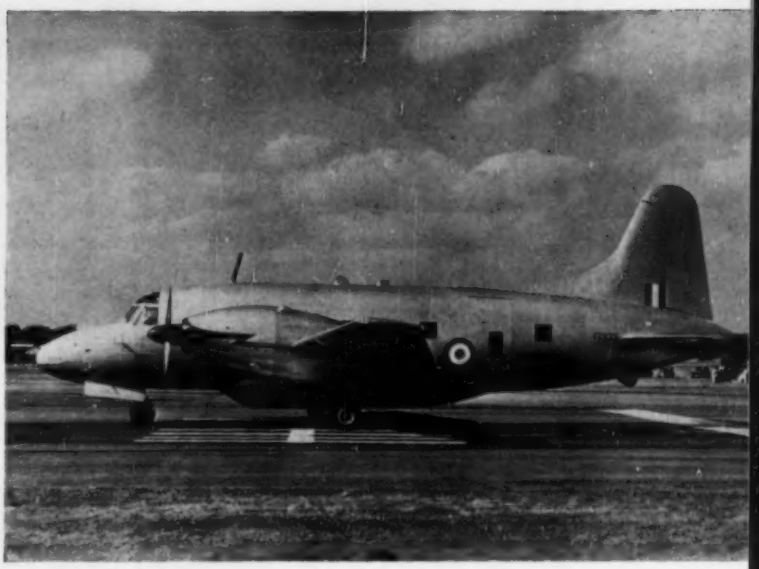
Eland Flight-testing

THE stage is set for the Napier Eland to build up a great number of flight hours during the New Year. This advanced turboprop, provisionally rated at 3,000 s.h.p. but likely to produce 4,000 with development, was first seen at Farnborough in the Varsity test-bed illustrated. Following strain-gauge work on the airscrews, the aircraft is about to undergo a further period of intensive flight-testing from the company's base at Luton Airport.

In addition to the Varsity, the American Convair 340, flight-delivered to Luton a few weeks ago, is now being prepared to take Elands. Reference to this conversion work which is quite a major undertaking and will probably not be completed until next summer, was made in our issue of November 5th. The Convair was flown *via* New York and Gander, whence it made the direct crossing to Shannon and then went on to Prestwick for Customs clearance. Its next stop was Cranfield, from where the pilots were taken to Luton in a Proctor to inspect the grass airfield. Finally, the machine was flown in, "keeping moving over the sticky bits."

Napier's chief test pilot, Mike Randrup, took part in the delivery flight after doing a conversion course on to the 340 at the makers'

DARK STRANGER: This Meteor 7 with all-black finish is operated for the Royal Navy by Airwork, Ltd. (pilot, D. E. Helmore) from Langley airfield. Its test work, on the other hand, is being carried out under the direction of the Sperry Gyroscope Co. It will be noticed that the aircraft has wide intakes and spring-tab ailerons, and that it appears to have an optically flat circular panel in the extreme nose. As a result, the normal ventilating-air intake now protrudes slightly below.



***SLIM ELAND** turboprops are almost lost in the fat cowlings of Napier's Varsity test-bed, which has already completed a valuable part of the Eland's flight-test programme. Conversion of a Convair CV-340 will shortly take place (the aircraft arrived at Luton on November 25th) and, initially at least, the original portly piston-engine nacelles will also be retained on this aircraft.* "Flight" photograph

plant. On the Eland tests he is being assisted by Ken Cartwright.

In addition to these two test-bed aircraft, a Ministry of Supply Ambassador, G-ALFR, is to be delivered to Luton in January with a view also to receiving Elands.

Two Napier executives, Mr. H. Sammons, managing director, and Mr. R. M. Hilary, commercial manager, have just returned from the United States where they have been discussing, among other things, Eland applications; it is hoped that in due course they will be able to report favourable developments. There is a distinct advantage in being able to discuss an engine which is not only running but flying, as opposed to comparing paper designs and theoretical figures. It is known that Convairs are themselves very interested in the Eland and that the possibility of offering a turboprop conversion kit to existing Convair operators is in mind.

The Eland itself was fully described in our issue of July 23rd last. It is a particularly neat single-shaft engine, with good component efficiencies and so built that it has accessibility which is almost certainly unique. Exhaustive testing already completed should ensure that the engine will obtain a C. of A. next year. Reference has also been made to a more complex E.151 Eland which is under development for the Fairey Rotodyne helicopter.

Super-super Connie

IT is reported that the Lockheed Aircraft Corporation is making an intensive effort, on a global basis, to interest suitable customers in what must surely be the final variant of the Constellation. Designated Model L-1449, the new project will be powered by four 6,000 e.s.h.p. developments of the Pratt and Whitney PT2F turboprop (T34 in military parlance), and is being promoted as the world's fastest, longest-ranged and most economical airscrew-driven transport.

Though the 1449 will not differ greatly in appearance from the U.S. Navy's R7V-2 (a T34-powered Super Constellation), it will be, in fact, a wholly new machine. The wing will have 27ft more span (to 150ft) and 206 sq ft more area (to 1,856 sq ft); the root thickness/chord ratio will be reduced by 16.7 per cent (of the original 18%) and, probably as a direct consequence, the structure will have a single integrally-stiffened sheet running from root to tip between the spars on both lower and upper surfaces.

Other airframe modifications will be aerodynamic refinement of the tail, a revised wing trailing-edge, full-length control surfaces, anti-friction bearings for the ailerons, and leading-edge anti-icing by bleeding hot air from the engine compressors. The main landing-gear is completely new (possibly with four wheels on each leg) and is stressed for use as a speed brake; it can be dropped at speeds in excess of 400 m.p.h. (presumably i.a.s.) and swings over-centre and locks down. The nose leg is also new and has an electrically powered hydraulic emergency extension system, with manual stand-by.

So far as can at present be ascertained, Lockheed are retaining the present L-1049 fuselage. The new machine is being offered with seating capacity varying between 60 (plus four-seat lounge) for international first-class services and 89 seats for domestic coach (tourist) operations. In the first-class configuration the payload with full tanks is 17,400 lb. The maximum tankage is 10,200 U.S. (about 8,500 Imperial) gallons, the specified fuel being JP-4.

Maximum take-off and landing weights are, respectively, 177,000 and 125,000 lb. Cruising speed is estimated at 432 m.p.h. at 20,000ft at 150,000 lb, or 410 m.p.h. at 30,000ft. Typical estimated block times are: Los Angeles/New York, 5 hr 50 min eastbound with summer tail-wind and 7 hr 20 min westbound with winter head-wind; Copenhagen/Los Angeles, 17 hr westbound with one stop and 14½ hr return with one stop.

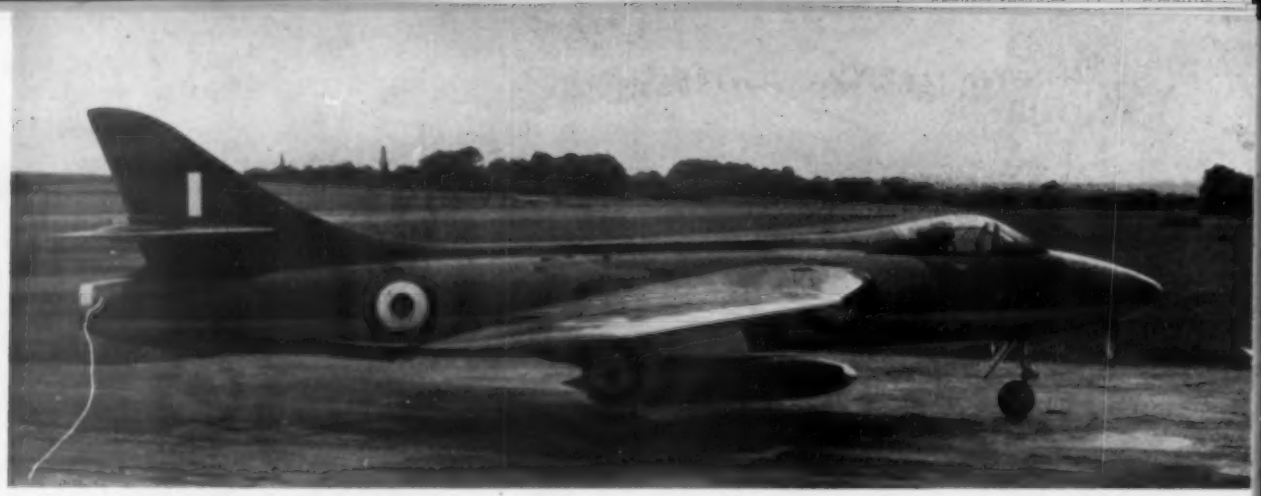
Lockheed are reported to be offering the L-1449 for delivery during 1957. It is not yet clear whether construction of a prototype has been authorized. For our own part, we do not doubt the ability of such an aircraft to cruise at the values quoted; it would seem, however, that—unless Pratt and Whitney produce a completely new engine—the L-1449 will be completely outperformed by other aircraft, such as the BE-25 Britannia, in range, payload and economy.

Airborne Radar Discussed

DEVELOPMENTS in airborne radar equipment have for some years been closely studied by the International Federation of Air Line Pilots Associations, who desire to see such equipment in general use at the earliest possible date. A one-day technical meeting between the pilots and representatives of the industry, which took place in London last Friday, proved a most useful occasion for the interchange of ideas on airborne radar systems and techniques of operation.

The chairman of the meeting was Capt. J. Woodman, chairman of B.A.L.P.A., deputizing for Mr. C. N. Sayen, president of I.F.A.L.P.A. Opening the meeting, he pointed out that considerations of safety and of economics both entered into the question of the adoption of airborne radar: in the pilots' opinion, safety should predominate. The meeting would provide an excellent occasion for pilots to learn more about the equipment, and for the industry to become acquainted with the pilots' point of view. Although, emphasized Capt. Woodman, it was true that the use of airborne radar equipment should lead to the avoidance of most bad-weather conditions, with consequent reduction in gusts experienced, the Federation was not putting forward the adoption of such equipment as a reason for decreasing structural strength factors in aircraft.

During the morning session, the representatives of Bendix Aviation, Decca, Ecko Electronics and R.C.A. described in turn their company's airborne and ground equipment. The afternoon's activity included the description of further equipment and a general discussion. The Ministry of Transport and Civil Aviation, I.C.A.O., the Air Registration Board and the Meteorological Office were represented at the meeting, in addition to the national pilots' associations of many countries, and manufacturers. A total of about 70 people were present.



DROP TANKS, HUNTER STYLE: Where transonic aircraft are concerned, even such an apparently simple operation as developing a drop-tank installation becomes fraught with difficulty. The Hawker company have now perfected the installation of under-wing tanks for the Hunter, shown here fitted to an early production Mk 1. Each tank appears to be of about 100 gallons capacity, and, surprisingly enough, no stabilizing fins are visible. It will be agreed that far from spoiling the Hunter's graceful outline these tanks lend a new, purposeful air.

FROM ALL QUARTERS . . .

Keeping the Flying-boat Flag Flying

PURCHASE of three 44-seat Short Solent 4s from Tasman Empire Airways is announced by Aquila Airways, Ltd., whose managing director, W/C. Barry Aikman, left New Zealand on December 7th after completing the contract. Aquila already operate two Solents and three Hythes. Their new boats will be flown to England by Aquila crews during the next few weeks.

Last week the airline announced approval of its application for a new flying-boat service to Genoa and to nearby Santa Margherita on the Italian Riviera. The service will begin on June 4th next, with a return flight each Saturday to Genoa and another each Sunday, to Santa Margherita. Flights will start from Southampton, taking five hours for the 850-mile journey; proposed fares are £19 single and £34 4s return.

On June 2nd next year Aquila will resume their Southampton-Marseilles-Capri service. The cost of a tourist return fare to Capri will be £52, in place of the first-class fare of £66 charged when the service began this year—though, the company states, the standard of comfort will be the same.

D.H. Design Appointments

IN connection with the delegation of design-side duties between the de Havilland Hatfield and Christchurch factories, a number of new appointments were announced last week.

Under Mr. R. E. Bishop, C.B.E., F.R.Ae.S., design director, Mr. C. T. Wilkins, O.B.E., F.R.Ae.S., becomes chief designer (Hatfield) and Mr. W. A. Tamblin, A.F.R.Ae.S., A.M.I.N.A., chief designer (Christchurch). Mr. J. P. Smith becomes deputy chief designer (Hatfield). Mr. A. G. Peters, A.R.Ae.S., and Mr. E. R. Owen are assistant chief designers (Hatfield) and Mr. F. Hamilton, A.F.R.Ae.S., is assistant chief designer (Christchurch).

Australian Upper-Air Research

A RECENT report from Sydney claims that Australia has made "the most exhaustive tests carried out anywhere in the world" into the behaviour of upper-air winds. The research, which extended to a height of 65 miles, has been conducted in South Australia by a team working under the direction of Prof. Huxley, Professor of Physics at Adelaide University. Prof. Huxley said in an interview that previous knowledge of upper atmosphere winds was mainly confined to heights up to 40 miles. The South Australian investigations had shown that at an altitude of 62 miles wind speeds might reach 200 m.p.h. Winds got faster in summer and slower in winter as altitude increased, and they flowed from east to west in summer and in the reverse direction in winter.

"Tidal" winds had also been discovered which were caused by pulsations of the earth's atmosphere under the heat of the sun.

Prof. Huxley said that the research would be continued at Mawson, the Australian base camp on the Antarctic mainland. Data would also be sought from other latitudes in order to chart the complete pattern of upper-atmosphere winds.

Aviation in the House

A VARIETY of questions on aeronautical matters were the subject of written Parliamentary answers last week.

Mr. N. N. Dodds (Lab, and Co-op., Dartford) asked the Minister of Transport and Civil Aviation if, in view of the rescue by a U.S. helicopter from the South Goodwins lightship when other means were ineffective because of bad weather, he would consider the provision of a helicopter service for the saving of life at sea.

In reply, Mr. Boyd-Carpenter pointed out that such a service already existed. Naval and R.A.F. helicopters stationed at various places round the coast formed an integral part of the rescue facilities available and H.M. Coastguard did not hesitate to call upon them whenever they could help. He understood that the R.A.F. were planning to increase substantially the number of their helicopters on the coast.

Mr. J. Parker (Lab., Dagenham) asked how the loads carried by airliners used for trooping compared with maximum loads permitted to similar aircraft by B.O.A.C. Mr. Boyd-Carpenter replied that if the operational factors were similar the maximum load which might be carried was the same in either case.

Mr. R. Mason (Lab., Barnsley) asked the Minister of Transport and Civil Aviation to give details of the routes in respect of which he had received applications to operate helicopter services. In his reply Mr. Boyd-Carpenter listed the B.E.A. service from London Airport to Southampton, already approved and operating; B.E.A. services from Central London to outlying aerodromes, and from Gatwick to other aerodromes in the London area, the applications for both of which had been approved; and Silver

City Airways' services from Ferryfield to Ostend, Calais, Le Touquet and Boulogne, the applications for which had been approved subject to the consent of the French and Belgian Governments.

Mr. G. P. Finlay (Con., Epping) asked the Under-Secretary of State for Air if he was aware that R.A.F. Venoms had been suspended from operational flying, and whether he would make a statement.

Mr. George Ward, Parliamentary Under-Secretary, said that Venoms were not suspended from operational flying. He went on to repeat the official statement made three weeks before, which was to the effect that the temporary restrictions had been imposed, under which Venoms must not carry wing-tip tanks or perform certain manoeuvres, until modifications had been made. These modifications were already in hand. (As on the previous occasion, the de Havilland Aircraft Co. subsequently issued a statement pointing out that the restrictions "in no way referred to the structural strength of the aircraft".)

INTRODUCING THE R.B.109

New Rolls-Royce Turboprop: Dart Developments and Overhauls

NO aero engine has been more in the domestic and international news in recent weeks than the Rolls-Royce R.B.109 turboprop, named as a possible power-plant for the Douglas DC-7D intercontinental airliner, now under study by B.O.A.C. and other operators.

At Derby last week *Flight* representatives were privileged, during a tour of inspection, to examine a mock-up of the new engine, and it was learned that the initial nominal rating is 4,000 shaft horsepower plus 1,000 lb static jet-thrust.

For reasons of policy—Rolls-Royce do not believe in talking about an engine until it has run and proved itself—and of both military and commercial security, we are not permitted to say anything about the interior of the R.B.109. All Rolls-Royce gas turbines are inter-related, and it is to be expected that this new civil design embodies a number of features held in common with new military units.

It is externally apparent that there are high-pressure and low-pressure compressors, and a multi-stage turbine. For its output the R.B.109 is of astonishingly small dimensions, and the power section itself is of "wasp-waisted" form. At the forward end is the reduction-gear casing, of relatively large diameter, and carrying a prominent oil-cooler; accessories are mounted below the forward portion of the engine.

Airflow, it was learned, is about twice that of the Dart, i.e. 40 lb/sec. Compressors and turbines for the R.B.109 are already running, and a complete unit should be on test early in the new year. Specific consumption should be lower than attainable with the best compound piston engine. (Optimum figure for the Wright Turbo-Compound is 0.38 lb/h.p./hr, and for the Napier Nomad, 0.327 lb/h.p./hr.)

One purpose of this invitation visit to Rolls-Royce was to enable us to study the impressive department that has been built up to deal with Dart major overhauls and the development of the Dart with a view to improving overhaul life and performance. We were also able to see something of associated departments dealing with customer relations, spares provisioning and questions arising out of maintenance.

Displayed was a Dart Mk 505 (placarded as having a service engine life of 1,514 hr, 815 hr since the last overhaul, and flame-tube life of 422 hr) and a typical "performance development engine", having no name and, possibly, no future, though it is certain that the rating of the Dart will be further increased. The engine shown had shrouded compressor-rotors (with the object of containing air leaks), and three turbine stages—the two-stage arrangement tending to be somewhat overworked under the altitude-cruise condition. Refinements in control, whereby it is possible to set the maximum attainable temperature for the selected engine speed, have also been introduced in this development engine.

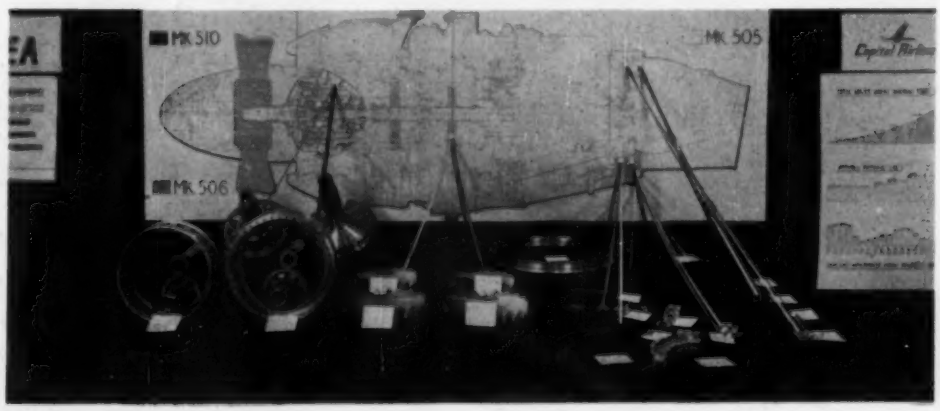
Mr. J. D. Pearson, director and chief executive of Rolls-Royce's aero division, reminded us that the Dart was originally built for military use and was subsequently "picked up" by Vickers as the power plant of the Viscount. Rolls-Royce considered it a great compliment that Air France, Aer Lingus, T.C.A. and T.A.A. had all ordered Viscounts before the type was in service with B.E.A., though by the time the first examples were going into regular service—in April last year—the Dart already had eight years of development behind it and 15,000 hr of development running.

In total, incidentally, the Dart has now completed some 36,000 hr development running—a figure which includes nearly 20,000 hr of test-bed and hangar operation, and 16,000 hr flying in Dakotas, Wellingtons and the prototype Viscount. Nearly a quarter of a million more engine hours have been logged in regular airline service to date with B.E.A., Air France and Aer Lingus.

With Lord Hives, chairman and joint managing director of Rolls-Royce, and Mr. D. P. Huddie, development engineer, Mr. Pearson returned about seven weeks ago from the U.S.A., where the party found that the turboprop had "suddenly arrived". American executives had flown extensively in the Viscount on European routes and were seeking to purchase Darts for themselves—with the intention of finding the aircraft in which to install them. Rolls-Royce, however, decided to give Vickers a clear run on the British-built Dart until January 1958, excepting only non-competitive installations, such as the Fokker Friendship and Aviation Traders Accountant.

The design of the R.B.109, Mr. Pearson said, was begun in June 1953. A new Vickers transport aircraft was schemed for units of this type, and B.E.A. expressed interest in the possible re-engining of their Elizabethans. The industry at large, and the Ministry of Supply, displayed no direct interest, however, though major airlines began to get "more than interested". In particular, it appeared that the engine would suit a Douglas DC-7 development "rather nicely". That the DC-7D would be built, said Mr. Pearson, was certain; but whether the power plant would be R.B.109s or Pratt and Whitney turboprops are still in question.

From 1946 to date Rolls-Royce have sold for export engines and spare parts to the value of over £44½ million. Of this £11 million represented sales to civil customers, and about £20 million represented sales to dollar countries. Export orders outstanding were valued at over £21 million. As for production, over 21,000 turbojet and turboprop units of Rolls-Royce design had been manufactured in Great Britain, America, France, Belgium, Sweden, Australia and Canada—roughly 13,000 of them in the Rolls-Royce factory at Derby.



This display to indicate routine Dart development shows early and later components for comparison. The improved reduction gear with helical low-speed train is seen on the left (not only does it absorb the greater power output but runs more smoothly); the thin-blade polished compressor lead-in vanes (previously they were shot-blasted and thicker); the new shrouding for turbine blades and the new optimum-spaced nozzle guide vanes.

HERE AND THERE

THRUSTFUL: An Avro Canada CF-100 Mk 4 (the rocket-armed version now being delivered to the R.C.A.F.) thunders aloft under the combined impetus of two Avro Orenda 11s and belly-mounted rocket bottles. This particular Mk 4 is without the usual tip-mounted rocket pods, housing "Mighty Mouse" air/air missiles.

German Air Force Chief

OFFICIALLY nominated to command the new West German Air Force—which, it is rumoured, may have over 1,400 aircraft—is General Galland. Now 42 years of age, he has for the last five years acted as Air Force adviser to General Perón in Argentina. As a Luftwaffe fighter pilot Galland is said to have shot down 96 allied aircraft; in 1945 he was himself shot down by a Mustang.

Conversion

TOKYO RADIO reported recently that thirteen Japanese pilots were about to graduate from a U.S.A.F. flying school in Northern Honshu. The graduates, who were pilots before they entered the school for a conversion course to jet aircraft, are to act as instructors in the new Japanese air force.

Helicopter's High Take-off

WHAT is believed to be a record take-off altitude for a helicopter operating in tropical temperatures has been achieved by an R.A.F. Bristol Sycamore in Kenya. With three up, it ascended at a point 8,430ft high in the White Highlands, about 50 miles south of the equator.

R.Ae.C. Film Show

NEXT Tuesday, December 21st, the R.Ae.C. will hold the second of its winter film shows. The four films to be screened are: *Wings Over Dexter* and *Masters of Maintenance*, both by American Airlines; the Handley Page film *The Crescent Wing*; and the picture shown at the recent Lighter-than-Air Reunion, *The History of the Rigid Airship*. The show, which begins at 6.15 p.m., is confined to R.Ae.C. members and associates and their guests.

French Scientist Honoured

HIS friends in Great Britain and America will be glad to hear that Professor Maurice Roy, member of the Academy of Sciences (Institut de France, Paris), and director of the O.N.E.R.A. (Office National d'Etudes et de Recherches Aéronautiques), has been appointed a *Commandeur* in the order of the Legion of Honour, in recognition of his services to aviation. Professor Roy is a Fellow of the Royal Aeronautical Society and of the Institute of the Aeronautical Sciences.

M.o.S. Appointment

THE Ministry of Supply announce that Mr. S. F. Follett, B.Sc. (Eng.), M.I.E.E., has been promoted to chief scientific officer and appointed Principal Director of Equipment Research and Development (Air). Mr. Follett, who is 50 years of age, has been Director of Instrument Research and Development since 1950. He joined the electrical engineering department of the R.A.E. at Farnborough in 1927.

Synthetic Lubricants

ACCORDING to Dr. Charles Raley, of the Southwest Research Institute, San Antonio, Texas, even the synthetic turbine-oils introduced for use in most of the latest gas turbines will not prove adequate for the conditions which will be met in combat aircraft of the immediate future. The Institute has, for two years, been working under a U.S.A.F. contract to develop a lubricant which would remain stable at temperatures higher than 500 deg F; and Dr. Raley believes that they have found preparations which will meet the specifications. "They should," he said, "be better and cheaper than the synthetic lubricants now in use."

LE TUBE À FLAMME: Col. A. J. B. Puget, D.S.O. (centre) French Air Attoché in London, with (left) Cmdt. Andlauer, Assistant Attaché, are shown a Proteus component by Mr. J. R. Bradford during a recent visit to the Bristol engine division.

Burma-bound Vampires

THE first four of eight Vampire trainers ordered for the Burmese Air Force left Hatfield on December 6th for Rangoon. They were flown by Mr. George Errington and three ferry pilots of Airwork, Ltd. The quartet covered the first 620 miles, to Marseilles, in 1 hr 35 min.

Birthday Gift

TO commemorate his 75th birthday, Sir Louis Stirling has given £200,000 to charity, £10,000 of this sum going to the Royal Air Force Benevolent Fund. Until his retirement Sir Louis was managing director of Columbia Gramophones and E.M.I.

Prospective Purchase

A STORY is told of the new Rolls-Royce overhaul factory in Australia. When Mr. J. D. Pearson (director) went out to purchase the land alongside the airfield at Mascot, N.S.W., he cabled home the price that was being asked. From Lord Hives, the company's chairman, came this cable in reply: "Go ahead and buy. Assume there is gold underneath."

Air Survey Interest

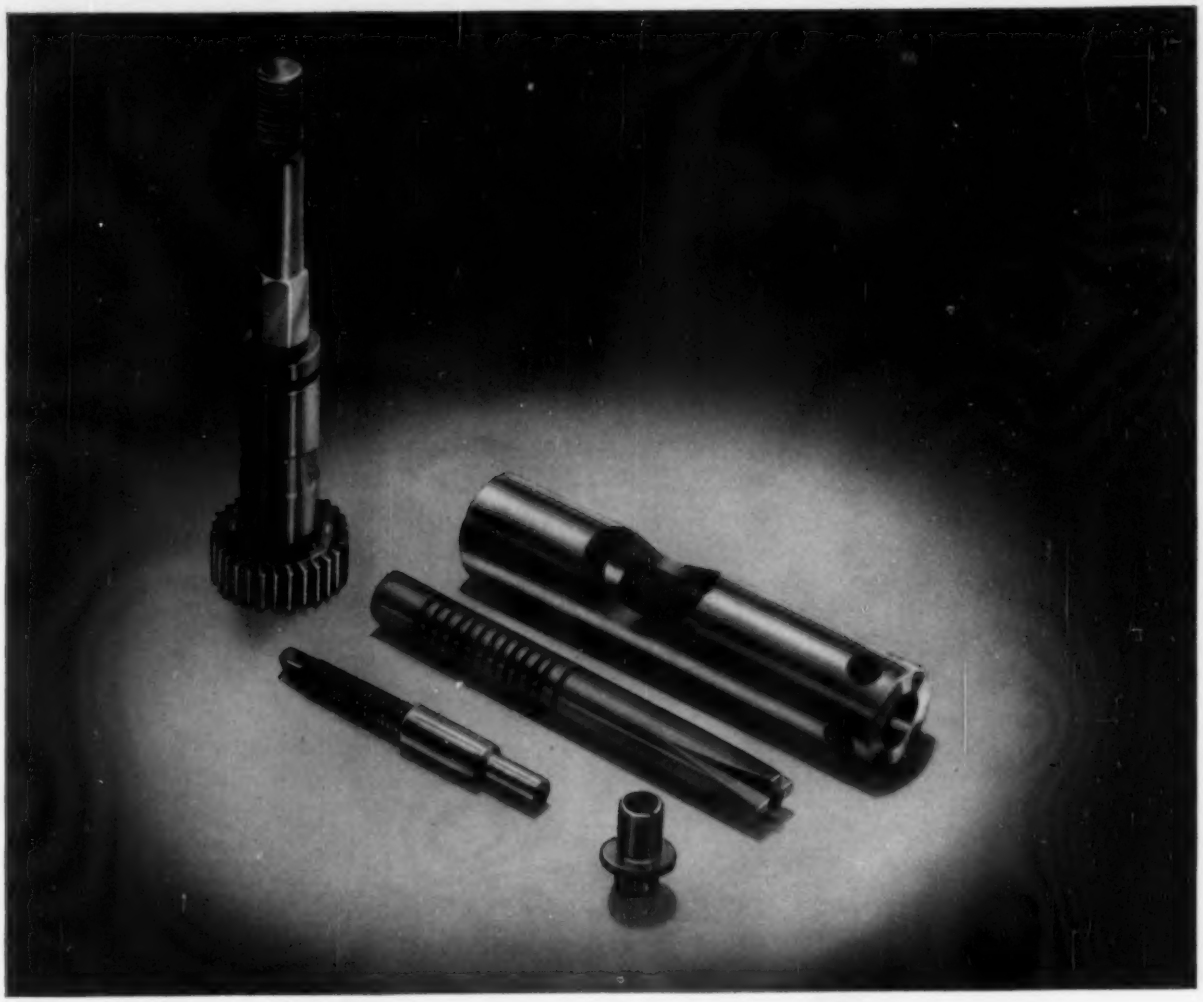
IN his chairman's speech at the annual general meeting of the Photogrammetric Society, G/C. F. C. V. Laws said that, in a little over two years since the Society's formation, membership had risen to a total of over 300.

Physical Society's Exhibition

FOR its next annual exhibition of scientific instruments and apparatus (April 25th-28th) the Physical Society will change the exhibition venue from Imperial College to the New Hall of the Royal Horticultural Society at Westminster. Some 140 exhibitors are expected to take part.

Appropriate

SWINDON Education Committee has approved the holding of a course of lectures on *The Problems of High-speed Flight* during the spring term of The College, Swindon; the lectures will be held in conjunction with Bristol University. (Not far from Swindon is the South Marston factory of Vickers-Armstrongs' Supermarine division, where the Swift is built.)



Fuel flow is controlled by the throttle valve components which are of high accuracy and surface finish within twenty-millionths of an inch.

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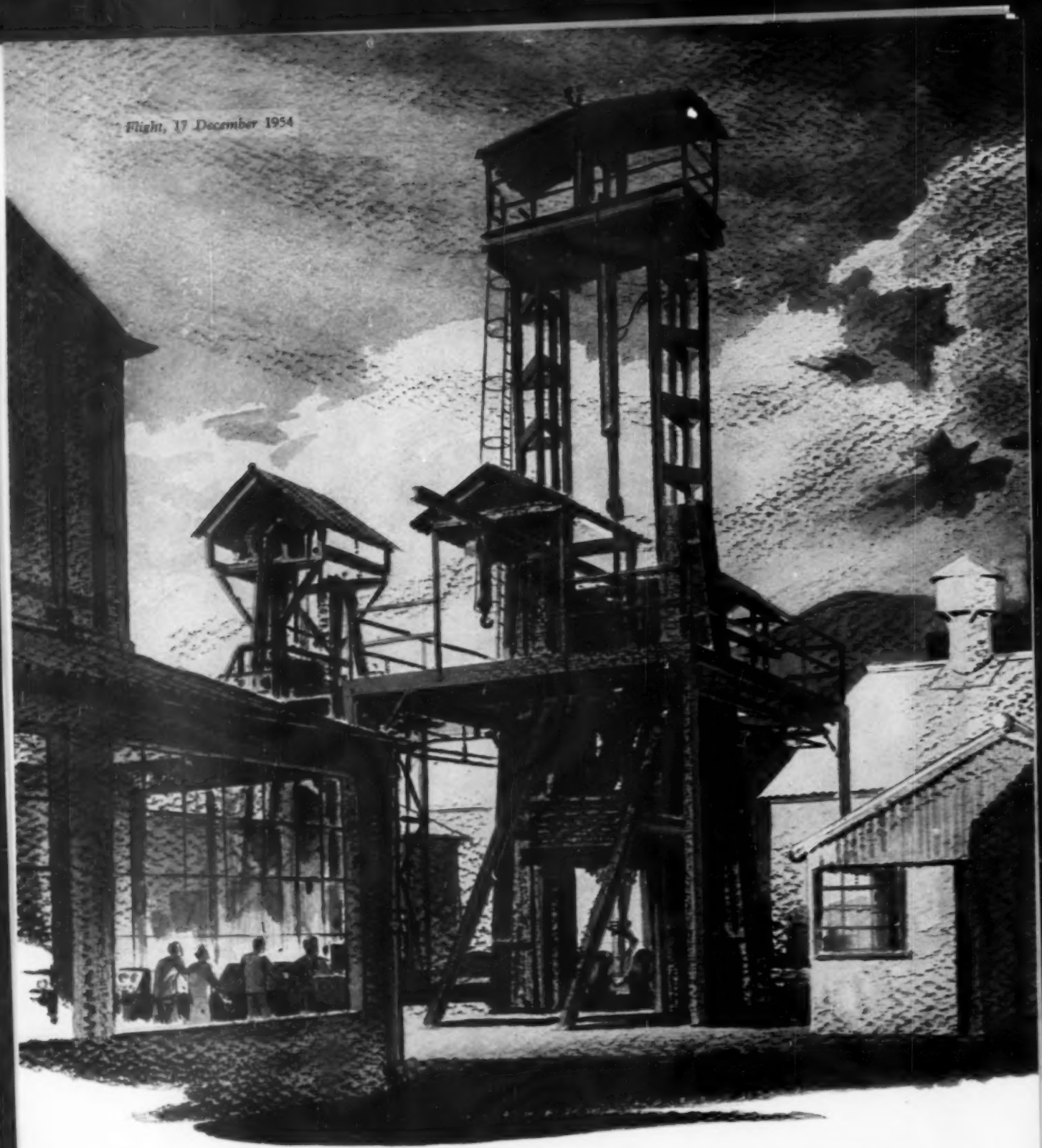

UNDERCARRIAGE DROP TEST MACHINES

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An Avianca DC-4 on the Loadair at Soledad Airport, Colombia, where the system has been in operation for some time. A second Loadair is now being installed at New York International Airport (Idlewild).

KEEPING A CLEAN APRON

New York Takes a Second Look at "Streamlined" Airport Handling

THE speed, economy and convenience of air transport all benefit from reductions in turn-round time at airports. In this unspectacular sphere of activity Europe usually lags behind America: for example, the average time spent on the ground at transit stops by local-service DC-3s employed on short stages is around 11 minutes in the United States, compared with nearly half-an-hour in Europe. Admittedly, extra documentation required by Customs and other authorities has an adverse effect on European operations; but there is still room for improvement.

A novel approach towards streamlining ground handling at airports is the Loadair system, produced by the Whiting Corporation of Illinois and illustrated on this page. The pictures were taken at Soledad Airport, Barranquilla, Colombia, where it has been in use for some years without attracting much attention. The system was first referred to and illustrated in *Flight* three years ago.

Interest in the Loadair has lately been revived, however, by the news that an installation of this type is to be tried out at New York International Airport (Idlewild); American Airlines are to use it for handling passengers and their baggage.

The system is best summed up by the phrase "mechanical parking". The pilot brings his aircraft to rest on a rail-mounted, electric-winch-driven conveyor almost flush with the apron, or ramp (as the marshalling area is called in America). The aircraft is then brought in, crab-wise, to a fixed loading dock. Passengers can thus step off the aircraft straight on to a covered walkway leading into the terminal building, while their baggage is simultaneously being taken by conveyor belt into the "claim area."

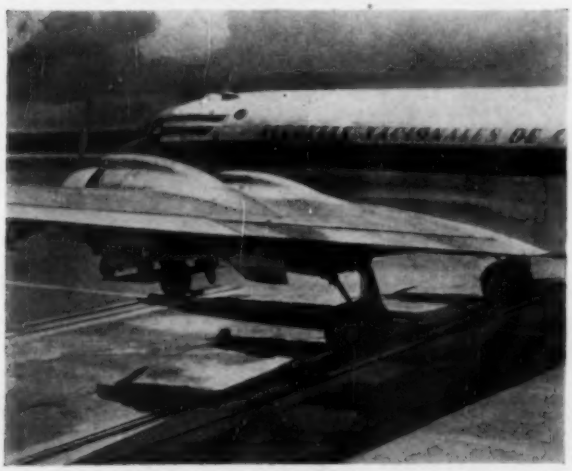
Some of the many advantages claimed for the system are enumerated below. In the first place, manœuvring time is reduced, because the tricky final stage is entirely automatic. For the same reason, more aircraft can be parked on a given space in front of the terminal building if Loadairs are installed in parallel. Servicing, it is claimed, is simplified by the ability to use fixed fuelling, electrical and maintenance installations, and other savings may result from reductions in the number of staff and amount of mobile equipment for the marshalling area.

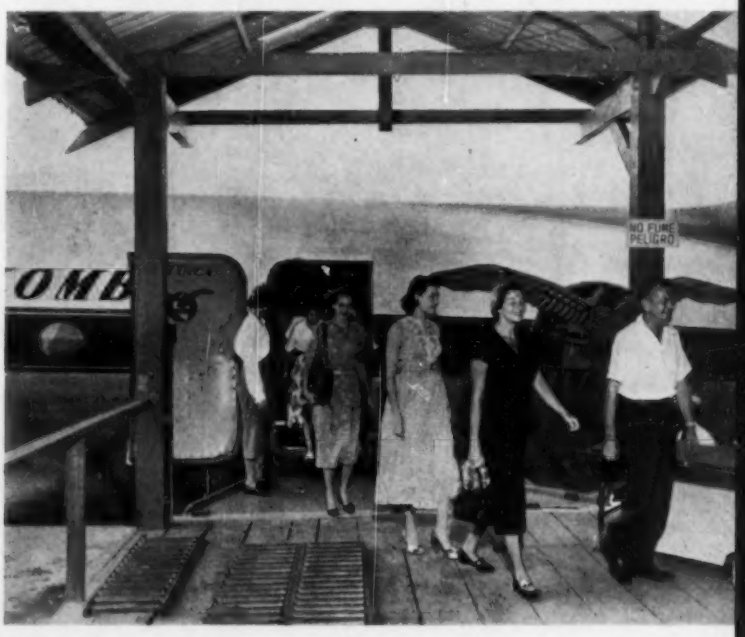
From the passenger's viewpoint, the most obvious advantages of the scheme are the abolition of the walk across the apron and up the steps into the aircraft, and protection from unfavourable weather. The cost of installing Loadair is said to be low, and it is claimed that savings in expenditure on paving the apron will sometimes equal or exceed the cost of installation.

It is reported from New York that the Whiting Corporation is bearing the cost of the Idlewild installation as a sales-promotion effort. American Airlines will maintain the Loadair in operation, but the space required and the electrical power are being supplied free by the Port of New York Authority.

Passengers disembarking from a DC-4 at Soledad (right); note that the cabin door is almost flush with the covered permanent dock.

(Below) The DC-4 is shown in position on the loading cars, ready to be moved into the dock.





E.T.P.S. EVENING

Caricatures by SALLON

The Speeches at the McKenna Trophy Dinner

AS briefly recorded last week, the graduation of the thirteenth course from the Empire Test Pilots' School at Farnborough was marked by the annual dinner, held in the test pilots' Mess, at which the McKenna Trophy was awarded. The joint recipients, those who obtained distinguished passes, and the names of the other members of the course, are listed below.

The Commandant, G/C. S. Wroath, A.F.C., welcomed the guests and, as is the custom on these occasions, reviewed the year's achievements. He began by saying that, on the technical side, some progress had been made in bringing into perspective the greater importance of jet-engine performance in comparison with that of piston engines. They had also introduced turboprop performance into the syllabus. Bearing in mind the future emphasis on supersonic flight, the syllabus had also been adjusted to introduce supersonic aerodynamics.

In regard to the flying syllabus, some changes had been made to the training at the beginning of the year to maintain a proper perspective in relation to the needs. "Our main effort," said G/C Wroath, "was directed towards getting more information from each hour of flying. Flying is ever becoming more costly, and we considered that such a move was in keeping with the times and in the spirit of progress in test and development flying generally. The students' awareness of the importance of this factor has contributed very substantially towards something like a 30 per cent saving in flying time over that of last year. As the school is non-profit-making this means that next year it may be possible to produce three students for the price of two. We have been able, within this year's allocation of flying time per student (approximately 105 hours), to complete additional exercises over and above the normal syllabus."

The Commandant went on to say that the school's aircraft fleet had been adequate for all the flying time needed. During the year the variety of the fleet had been greatly improved by the permanent addition of Hunter, Canberra and Sea Hawk aircraft. Admiral John had tried hard to get a Wyvern for the school, and he (the Commandant) was sorry that this aircraft was subsequently "dispensed with harshly and rapidly." They were looking forward to receiving a Gannet soon. Some delta flying had been "borrowed" from Boscombe; this was in the nature of an experiment, but perhaps it would open the way to a similar arrangement for other aircraft. With such a facility they should be able to keep right up-to-date, and to keep the running costs of the school down.

G/C. S. Wroath, to be succeeded as Commandant by G/C. D. C. McKinley (right)

Vice-Admiral Caspar John, R.N.

Some helicopter training facilities had also been established. All students on the present course had been introduced to rotating-wing aircraft, with varying results. A complete training scheme would be introduced in a week or so.

During the year the school continued visits to the aircraft and allied industries. The educational value of these visits was immeasurable, for it brought the whole problem of aircraft development and production into proper perspective, not only for the students from a test-pilot point of view, but for them as Air Force officers generally.

W/C. "Roly" Falk

G/C. R. G. Slade

S/L. E. A. Tennant

Lt-Cdr. "Mike" Lithgow

Turning to the future, G/C. Wroath said that the school was expecting a further improvement in facilities, aircraft and equipment. Approval had been given for an extension, costing £15,000, to the flying quarters, and this would benefit both staff and pupils. They had recently been provided with trace recorders which, when installed, should assist students to analyse their tests more fully and accurately, with a further saving in flying time.

G/C. Wroath continued: "We are also giving some thought to an electronic simulator which, for the time being, we choose to call a 'handling test vehicle.' We feel that such a piece of equipment will enable us to demonstrate to students and, indeed, experienced test pilots, potentially dangerous handling characteristics. We also wish to use it to demonstrate the different types of artificial feel. It will, of course, cost more than one of the aircraft in our fleet, but we feel that the long-term economy will be justified."

The Commandant then went on to analyse the constitution of the course just ended. It comprised three American students, two Italian, and one each from France, Holland and Thailand; of the Commonwealth countries, Canada contributed four students and Australia one, while from home were five from the Royal Navy and ten from the Royal Air Force. This was, said G/C. Wroath, a truly international gathering which had lived and worked extremely happily together.

Six students had merited Distinguished Passes: Capt. R. Bignamini (Italian Air Force), F/L. A. L. Blackman (R.A.F.), Lt. F. W. Botts, Jnr. (U.S.N.), Capt. R. M. Fernbaugh (U.S.A.F.) and F/L. E. V. Mellor (R.A.F.).

G/C. Wroath concluded his list of students' successes by naming the joint recipients of the McKenna Trophy, who, as we

A. Cdre. A. H. Wheeler

W/C. "Dicky" Martin

S/L. Neville Duke

recorded last week, were Capt. R. Bignamini of the Italian Air Force and F/L. V. J. Hill of the R.A.A.F. "We could not," said the Commandant, "without going to extremes, regard one as being better than the other, and we have therefore created a precedent by awarding the trophy jointly."

In the absence through illness of Air Chief Marshal Sir John W. Baker, the trophy was presented by Vice-Admiral Caspar John, Deputy Controller of Aircraft, Ministry of Supply. His speech—humorous, inspired, informative—was clearly appreciated; parts of it were obviously intended only for his audience of that evening. Almost with regret, it seemed, he mentioned that in contrast to his experience on previous visits he had not found himself practically blown from his chair by a thunderflash, but he added the hope that things might "improve" after dinner.

The Admiral said at first that it was significant that a Naval officer should be addressing the company, but he added that he had to remind himself that in his present post he was a Ministry of Supply official. Without being at all "admiralish," he remarked that flat-tops still had a part to play in filling the yawning gaps in land-based air power. He spoke also of a future possibility of the Navy and the R.A.F. combining—this, he thought, would be something to look forward to, for the two could do so much together. He also had something to say about "strange nautical flying machines," which the E.T.P.S. should deal with as they thought fit.

Discussing the remarkable international talent represented by the test pilots' course, Admiral John said that, to ensure quality of aircraft in the future, Service and industry test pilots should remain completely integrated, as they were on that occasion. It was not enough to produce a machine which flew perfectly throughout its speed range. All the equipment had to work and, to use the new expression, a "weapons system" was the requirement. The speaker concluded with good wishes to all the test pilots and for a moment recalled "Sam" McKenna before presenting the trophy named in his memory.

F/L. A. L. Blackman

A. E. ("Ben") Gunn

Deafening shouts of "Up, up!" and "Higher, higher!" next compelled the joint winners to climb in turn on their chairs and say a few words. Photographs were also taken of them, Capt. Bignamini being ordered to "say *formaggio*" for the purpose. Both recipients demonstrated in their short speeches that in this accomplishment, too, they were above average. Specially creditable, we felt, were Capt. Bignamini's thanks and comments in a language foreign to him. He felt, as did F/L. Hill, that the whole course ought to share the trophy, but he was nevertheless very proud to receive this most desirable prize that a pilot could be awarded. Before joining the course he had been somewhat frightened by what he knew of the high standard of flying, but he had been able to succeed as a result of receiving every possible kindness and help. In particular, he had learned how to fly safely in English weather and to cope with compressibility in a Venom. It had been a great experience to see people of many countries working together and enjoying the work of the E.T.P.S. The spirit was that of a NATO school. He liked to think of it, he said, as "our test pilots," the "our" meaning NATO.

Lt. F. W. Botts, Jnr., U.S.N.

Capt. R. Bignamini

F/L. V. J. Hill (joint Trophy winner with Bignamini)

E.T.P.S. COURSE No. 13—STUDENTS

Royal Air Force.—F/L. M. H. Beeching, F/L. A. L. Blackman, F/L. J. G. Burns, F/L. E. V. Mellor, F/L. G. H. Moreau, F/L. J. L. Price, F/L. R. T. Robinson, F/L. L. P. Stuart-Smith, F/O. R. Walker, F/O. C. K. Williamson.

Royal Navy.—Lt. N. N. Ducker, Lt. W. R. Hart, Lt. G. R. Higgs, Lt-Cdr. (E) H. G. Julian, D.S.C., Lt. D. J. Whitehead.

Royal Australian Air Force.—F/L. V. J. Hill, D.F.C.

Royal Canadian Air Force.—F/O. S. R. Kersey, F/O. J. A. Moyles, F/O. R. W. Smith.

Royal Canadian Navy.—Lt-Cdr. J. J. Harvie.

United States Air Force.—Capt. R. M. Fernbaugh, Capt. I. C. Kincheloe, Jnr. **United States Navy:** Lt. F. W. Botts, Jnr. **French Air Force:** Capt. J. Franchi. **Italian Air Force:** Capt. R. Bignamini, Lt. P. P. Trevisan. **Royal Netherlands Air Force:** 1st Lt. W. J. P. Heynen. **Royal Norwegian Air Force:** Lt. O. Brage-Anderssen. **Royal Thailand Air Force:** F/L. B. Sukhanusasna.

E.T.P.S. STAFF

Commandant.—G/C. S. Wroath, A.F.C.

Chief Test-flying Instructor.—W/C. K. J. Sewell, A.F.C., D.F.M.

Chief Technical Instructor.—Mr. J. A. Lang, B.Sc.

Tutors.—S/L. I. D. Crozier, A.F.C.; S/L. G. W. Johnson, D.F.C.; S/L. A. E. Marriott; Lt. E. C. Spreadbury, R.N. (Helicopters).

Flying Instructors.—F/L. G. Allan, M.C., A.F.C.; F/L. S. R. Garden, A.F.C.; F/L. O. A. Lines.

Flight Engineers.—F/L. P. S. Gees; F/L. T. Jones; F/L. J. A. McClune, D.F.C.; F/L. J. Roberts, D.F.M.; F/L. W. S. Welsh.

Signaller and Adjutant Flying.—F/L. W. Beaumont, D.F.C.

Staff Officer (Administration).—F/L. J. Bull.

THE BIG RECOGNITION CONTEST

ARRANGEMENTS for the annual All England Aircraft Recognition Contest—the eighth of the series—have been announced by the Aircraft Recognition Society. The event will take place on Saturday, January 22nd, at 2.30 p.m., in the lecture theatre of the Royal Institution, 21 Albemarle Street, London, W.1. As usual, the competitors will be very severely tested. They may have to identify some very unlikely aircraft, for the only limitation is that the machines shown must at some time or other have flown over the British Isles. Moreover, the photographs are exposed on a screen for one second only.

This year, Lt-Cdr. "Mike" Lithgow will act as an independent umpire and while the papers are being checked he is to give a talk on his flying experiences.

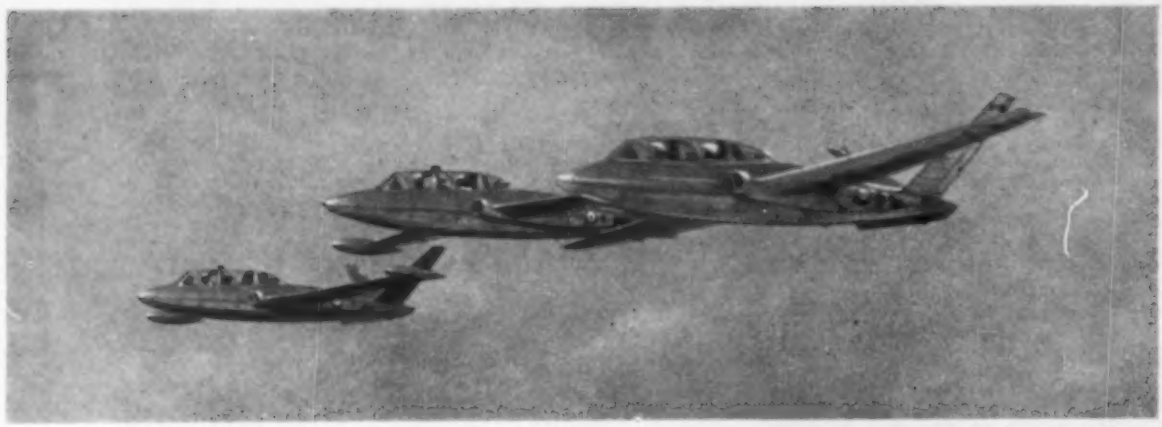
The competition is open to teams of three members representing any recognized club, society or body interested in aircraft, and to units of the Services, including the R.O.C., A.T.C. and W.J.A.C. Teams from the Services of the NATO powers are also eligible. In the last contest, 63 teams competed.

There will be the usual awards, including the "Silver Hurricane" and "Silver Heracles" Trophies and this year there is an additional prize in the form of the B.E.A. "Viking" Trophy, to be awarded to the Services team scoring the highest marks in the competition. The trophies will be presented at the close of the meeting by the president of the Society, Mr. Peter Masefield.

Full details and entry forms (the entrance fee is one guinea for each team) are obtainable from the Hon. Secretary, Aircraft Recognition Society, 15, Tavistock Street, London, W.C.2.

Two days ago, on December 15th, the Society rounded-off its year's events with the usual "forum" programme, held in the library of the R.Ae.S. The panel of experts due to take part, under the chairmanship of Mr. E. Colston Shepherd, were Mr. Peter Masefield; Sir Arnold Hall, director of the R.A.E.; Mr. Derek Lambert, senior designer (civil aircraft) Vickers-Armstrongs; and W/C. Maurice Smith, editor of *Flight*.

Questions down for discussion included "Should British airlines seek supremacy even at the expense of the British aircraft industry?", "What is the future of the light fighter?", "What are likely developments in V.T.O. aircraft?" and "Will runways be a thing of the past in 20 years?"



The Fouga Magister, 100 of which are now under construction for the French Air Force, has now (as mentioned in our pages last week) been formally approved as a standard basic trainer for NATO. Three prototypes are seen here during recent trials.

AIRCRAFT INTELLIGENCE

Great Britain

Short Seamew. As intimated in *Flight* of December 3rd, although the Short Seamew is basically a light anti-submarine aircraft, development trials have confirmed that it possesses capabilities for a wide range of other duties. A recent announcement names these as in-shore reconnaissance and coastal defence, communications, aerial survey, A.O.P. work and tribal control. Only comparatively minor modifications, it is said, are required to make the Seamew suitable for such duties; these include the fitting of oversize tyres to operate at reduced pressure, and the removal of the wing-folding mechanism, radar scanner and special navigational equipment. The fuselage, moreover, is of such dimensions as to accommodate a crew of three, instead of the naval complement of two.

U.S.A.

Douglas C-123. The Douglas Aircraft Company are modifying a C-124 Globemaster for experimental flying with a Pratt and Whitney T57 turboprop (presumably mounted in the nose), which is expected to be in the 15,000 e.s.h.p. class. Units of this sort will power the monster Douglas C-123 "logistics carrier", for which a 100,000 lb payload has been mentioned.

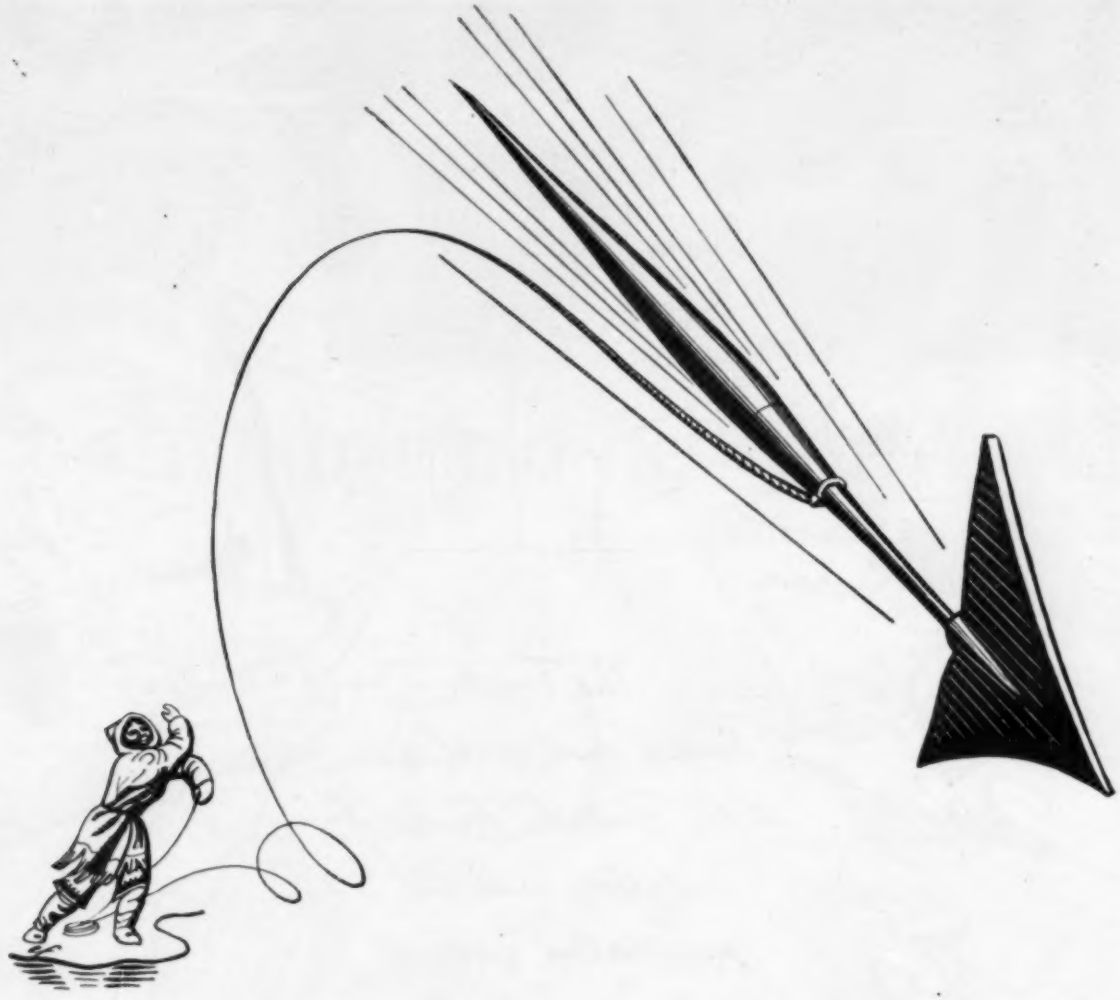
Douglas F4D Skyray. In company with Chance Vought (Cutlass) and McDonnell (Demon), Douglas have been finding it very difficult to convert the F4D Skyray supersonic carrier-based fighter into a genuine all-weather fighter, with full radar-fire-control. At least one development Skyray has been flying at El Segundo for some weeks with an extended nose radome—of Javelin shape—housing a twin-aerial array, but it is unlikely that the production F4D-2N all-weather machine will be delivered before next spring. The Skyray is, however, behaving very well in test flying and, on the power of its afterburning Pratt and Whitney J57, has exceeded Mach-1 on the level.

Douglas Supersonic Aircraft. Photographs have been published in the United States of a full-size mock-up of the Douglas 39C, a design now some six years old but which closely corresponds to the X-3 (*Flight*, November 27th, 1953). The Model 39C is seen to have a downward ejection seat incorporating an oxygen bottle, for use of the pilot after ejection, and a nitrogen bottle for operating seat-stabilizing fins. Boundary-layer bleeds under the twin engine intakes supply relatively cold air to shrouds surrounding the twin afterburners.

France

Breguet 940. A credit of 210 million francs has been awarded by the French Government to the Breguet company for research and experimental work on an aircraft of the foregoing designation. Following flight trials and proof of the qualities of the aircraft, an additional 500 million francs will be awarded for the construction of two prototypes, which should be capable of taking off and landing in 130ft. An existing powered model of the projected machine shows it to have a high wing. The four engines will be Turboméca gas turbines of 400 h.p. each, driving synchronized airscrews, and at low flying speeds the slipstream will be directed downward "by a special device controlled by the pilot."

The Hiller H-32 helicopter for the U.S.A.F. is the first ramjet-powered aircraft to go into production for an air force; it is also being built as the HOE-1 for the U.S. Navy. Beneath it is shown the third Vautour, S.O. 4050-03, which has provision for visual bombing from the nose. It first flew on December 4th, and is claimed as the first bomber in the world to reach Mach 1; time will show whether this claim is justified.



HIGH AERODYNAMIC EFFICIENCY

The Eland is an aero-engine giving high power at low cost. It is a single-shaft propeller-turbine developing 3,000 e.h.p. at take-off, with a diameter of only 36 inches. This compactness makes for high aerodynamic efficiency. Other notable features include smooth, surge-free acceleration, low specific weight and low fuel consumption. All in all, the Eland is an impressive example of design and manufacture at the service of commercial aviation.

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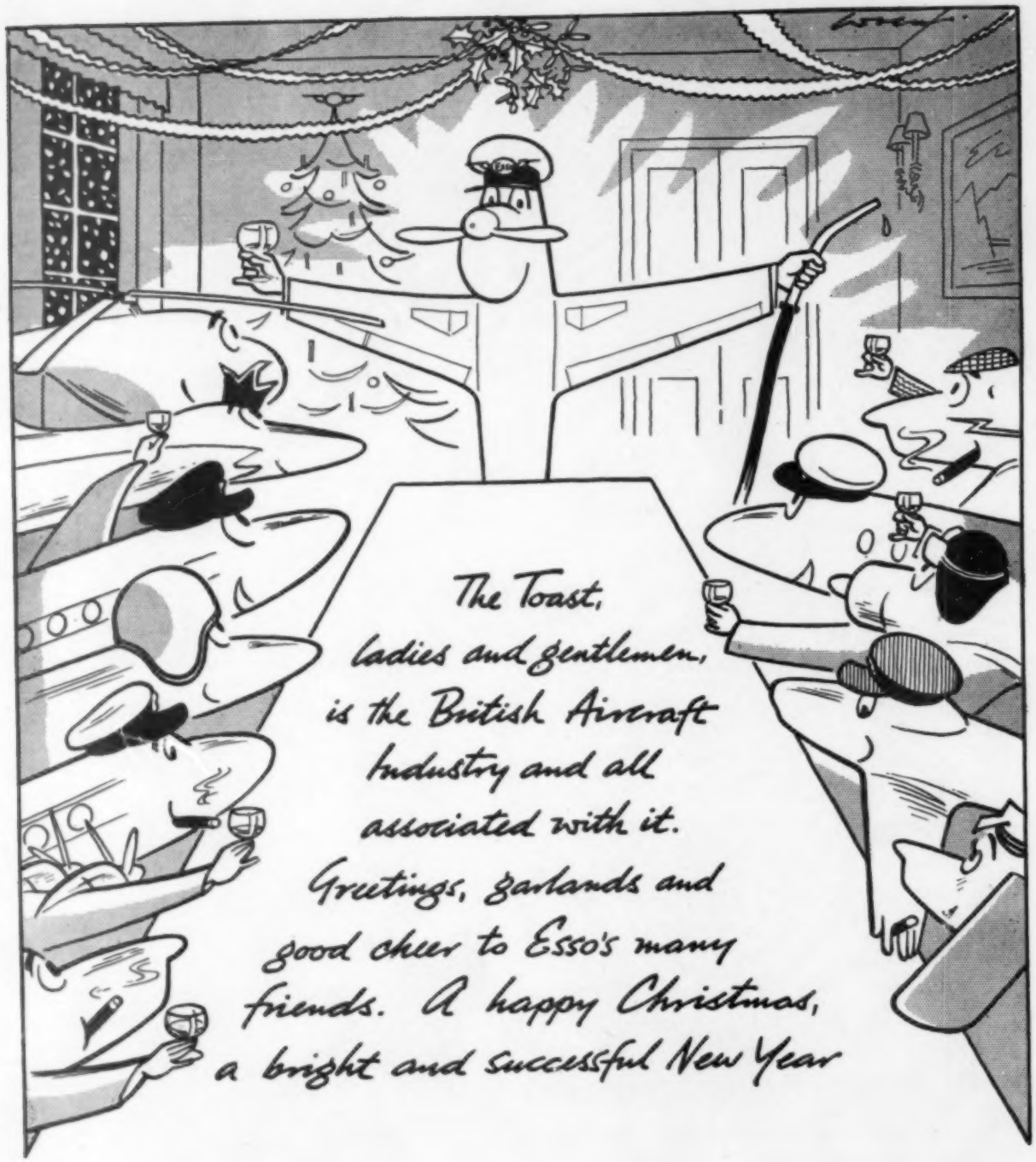

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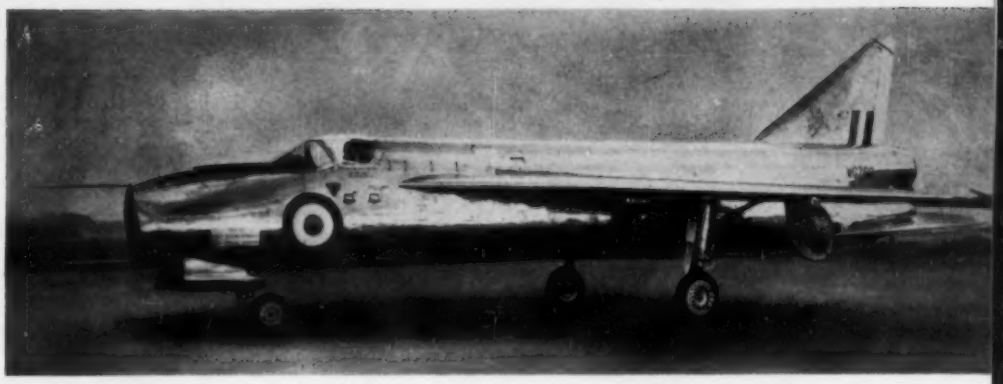


The first British fighter to attain supersonic speed in level flight was the English Electric P.1, powered with two Armstrong Siddeley Sapphire turbojets

THE SUPERSONIC FIGHTER

PART 2

By J. W. FOZARD, D.C.Ae., B.Sc. (Hons), Grad. R.Ae.S

THE effect of applying to the design of a supersonic fighter the process of aerodynamic refinement outlined in the first of this series of articles is demonstrated in the section which follows. Thereafter consideration is given to the choice of a powerplant.

4.6 Results. Figs. 6 and 7 compare the drag of the supersonic aircraft with the drag of a typical subsonic fighter under the same conditions.

Fig. 6 shows the variation of the total drag coefficient in level flight over the speed range. The relative shapes of the curves for the two aircraft should be carefully compared, as the shape of the supersonic machine has been evolved by application of the policy already outlined. The effectiveness of these measures is shown in the higher M_{crit}, the smoother drag-rise and the very much lower peak C_D of the later aircraft. It should be noted that beyond $M=1.5$ the drag coefficient of the supersonic fighter has settled down to an approximately constant value. This implies that at high supersonic speed the drag of the aircraft in level flight at constant altitude is increasing approximately as the square of the speed. The significance of this will become apparent in Section 6, where the performance of the supersonic fighter is discussed.

A more detailed analysis of the drag of these aircraft is presented in Fig. 7, which also gives the relative geometric particulars of the two machines. A study of this figure will reveal the relative effects of the aerodynamic refinements necessary for sustained supersonic flight. In particular it should be noted that, at this particular speed and altitude, these refinements have led to a position wherein the greatest proportion of the drag of the supersonic machine is due to viscous effects. Compare this with the subsonic fighter, where approximately 75 per cent of the total drag is wave drag. Note also that, although the percentage contribution to the total drag for corresponding components of the two aircraft is roughly equal, the absolute drag of each component of the supersonic fighter is very much reduced. For example, the canopy drag of the supersonic fighter is 7 per cent compared with 8 per cent for the subsonic fighter, but a comparison of the absolute drag of these components shows that the canopy drag of the later aircraft is only 40 per cent of the drag of the earlier canopy.

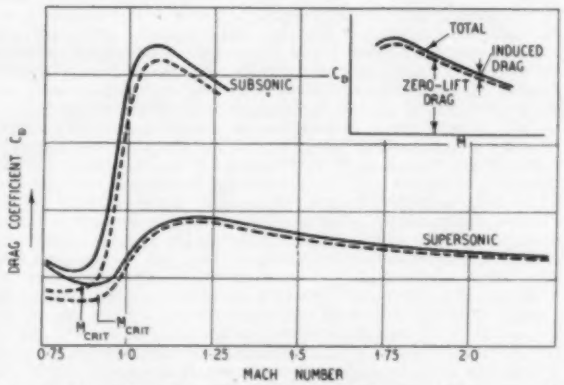


Fig. 6. Comparison of drag coefficients, based on gross wing area, for subsonic and supersonic fighters (level flight near tropopause).

For both aircraft it will be noted that the wing drag and the fuselage drag together account for approximately two-thirds of the total drag. It is obvious, therefore, that by concentrating his attention on these two components the designer can expect the most fruitful results from his labours. It follows, as a corollary, that if the refinement of these components is unduly compromised —due, say, to a requirement for a blunt radome on the fuselage nose, or an excessively rounded wing leading edge in order to enhance the low-speed handling qualities—then relatively severe

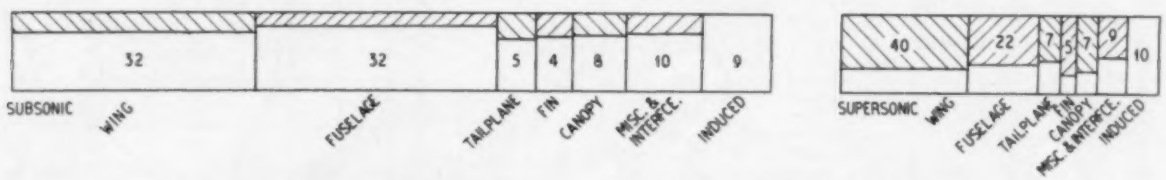


Fig. 7. Comparative drag breakdown of subsonic and supersonic fighters (level flight at M=1.0 near tropopause).

Key.—The shaded area in each block represents the approximate proportion of viscous drag; the figure gives the total drag of the component as a percentage of the total drag of the aircraft; the plain area represents the approximate proportion of wave drag; and the length of each block represents the actual drag of the component to a fixed scale.

Geometric Data (values for the supersonic fighter are given as a fraction of the corresponding value for the subsonic fighter).

		Fuselage	Canopy
Fineness ratio ($\frac{l}{d}$)		1.0	2.0
Max. X-sect. area		1.5	0.7
Wetted area		1.15	1.15
	Wing	Tailplane	Fin
¼ chord sweep	1.3	0.6	1.3
Area	1.25	1.05	1.25
t/c ratio	0.47	0.5	0.55

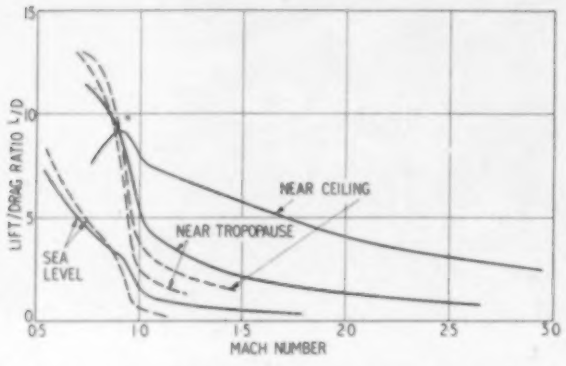


Fig. 8. Comparison of typical lift/drag ratios in level flight for subsonic (broken line) and supersonic fighter.

reductions in the performance of the aircraft may be expected.

To conclude this section, Fig. 8 compares the lift/drag ratio in level flight typical of a subsonic fighter with the values to be expected of a supersonic fighter. These curves illustrate the profound effect of wave drag at high supersonic speed in reducing the aerodynamic efficiency of the aircraft, even when all the refinements outlined in Sections 4.1 to 4.5 have been incorporated in the design. It is emphasized that these L/D ratios are those occurring in steady level flight and do not necessarily represent the optimum L/D ratio attainable at any given speed and altitude. At low altitude, and due to the high air density, the L/D ratio even of the supersonic fighter is extremely low at quite moderate supersonic speeds. For example, at sea level the supersonic fighter would require a thrust of approximately twice the aircraft weight in order to achieve a speed M = 1.5. The reader should note the catastrophic reduction of L/D ratio for the subsonic fighter, occurring at speeds just below sonic speed, which is virtually unaffected by altitude. In contrast to this, the supersonic fighter shows a substantial increase in efficiency with increase of altitude. Even so, thrusts of the order of 30 to 40 per cent of the aircraft weight are necessary in order to achieve speeds greater than M = 2.5 at high altitude.

To many aeronautical engineers, conditioned over a period of years to thinking in terms of subsonic L/D ratios which commonly exceed 12 or 15, the remarkably low efficiency of the supersonic aircraft is a cause of undisguised astonishment. These low efficiencies seem fundamental to the new flow regime, and in the present state of the art it appears unlikely that substantial improvements in efficiency will be achieved as a result of further research and development. The values of L/D ratio quoted in Fig. 8, whilst not perhaps representing the optimum, must at least be regarded as typical of the coming era. The designer, accordingly, must adjust his philosophy and accustom himself to the sober realities of supersonics, for such are the penalties exacted by nature as man extends the frontiers of his achievements.

5.0 Choice of Powerplant

5.1 Types. There are four types of powerplant available for the supersonic fighter:—

(i) *The turbojet engine.* This is the aircraft gas turbine now in common use on subsonic aircraft. The axial-compressor type is most suitable for development as a supersonic propulsion unit and, as the art of engine design advances, it seems likely that the simple turbojet, due to its comparatively low fuel consumption, will be the standard powerplant for supersonic aircraft.

(ii) *The turbo-ramjet.* When reheat (additional fuel injected and burnt in an enlarged jet-pipe) is added to the turbojet engine, the resulting powerplant has characteristics which lie between those of the simple turbojet and those of the ramjet. It is undoubtedly this form of powerplant which will enable the practical supersonic fighter to achieve operational status during the next several years.

(iii) *The ramjet or athodyd.* Having no moving parts other than the fuel pumps, the ramjet is the simplest and the lightest of the family of air-breathing powerplants. It has, however, several severe disadvantages which render it attractive only for ultra high-speed and special-purpose vehicles.

(iv) *The rocket motor.* The liquid-fuel rocket motor will find its place in the field of manned supersonic aircraft, but, due to its very high fuel consumption, its use is likely to be confined to thrust boosting for short periods of time at extreme altitude. Used alone as the main propulsive unit, the rocket is capable of endowing a small special-purpose aircraft with a truly fantastic performance at extreme altitude, but at the cost of permitting only a very short endurance.

5.2 Characteristics. The characteristics of these four possible powerplants are compared in Figs. 9 and 10, which are based on data given in a paper by M. Harned, Chief Designer of the Marquardt Aircraft Co.* Fig. 9 shows the variation of thrust/weight ratio and hence, for a given engine weight, the form of thrust variation with Mach number. It should be noted that the thrust of both the turbo-ramjet and the ramjet rise markedly with speed beyond the transonic region. In fact, for both types of powerplant the net thrust coefficient C_T ($= \text{Thrust} \div \frac{1}{2}\rho SV^2$) increases with increase of speed into the supersonic range. At a constant altitude, the net thrust can be expressed as $T = \text{Constant}.C_T.M^2$ and, since C is increasing with M, it follows that the thrust is effectively increasing proportional to M to a power greater than 2.0. It has been noted in Section 4.6 that, beyond the transonic region, the drag coefficient of the supersonic aircraft is decreasing with increase of speed; thus the actual drag is effectively increasing proportional to M to a power less than 2.0. It will be noted from these characteristics that beyond the transonic region the thrust and the drag are diverging—a further increase of speed from a particular level flight resulting in a further excess of thrust over drag. This phenomenon has a very important bearing on the performance characteristics of the supersonic fighter which are discussed in Section 6.

Returning to the consideration of the types of powerplant, Fig.

*"Application of the Ramjet to Aircraft Propulsion"—*Aero Digest, U.S.A., February 1953.*

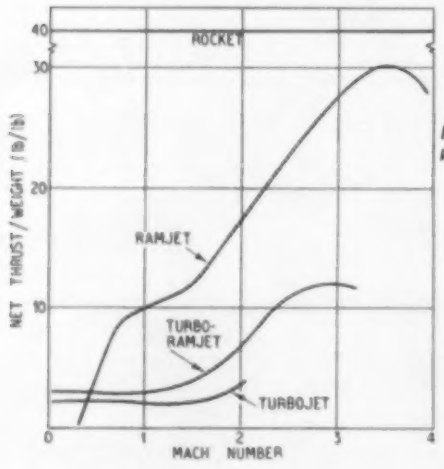


Fig. 9. Comparison of powerplant thrust/weight ratio at sea level.

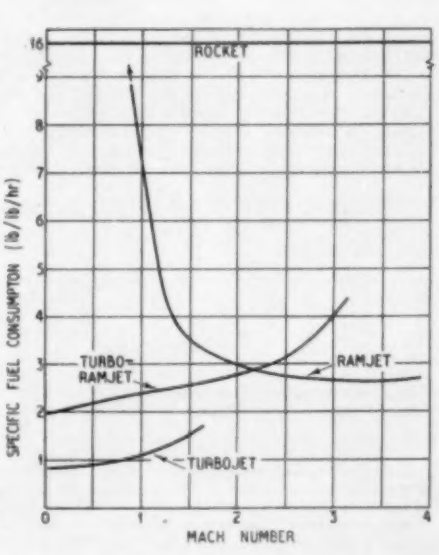


Fig. 10. Comparison of powerplant specific fuel-consumption at sea level.

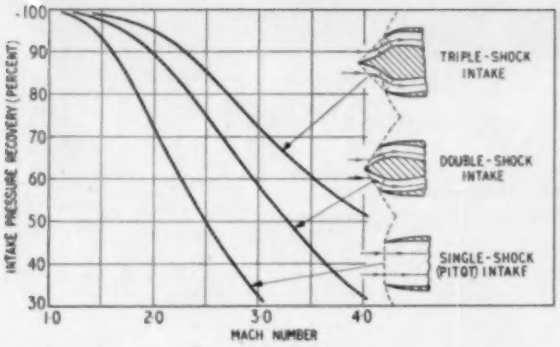


Fig. 11. Ideal pressure-recovery characteristics of air intakes (two-dimensional flow).

" . . . the design of a satisfactory intake [is] the most difficult single aerodynamic problem . . ." Shown is the intake of the North American F-100, the first fighter to attain supersonic speed in level flight.

10 shows the variation of specific fuel consumption over the speed range. The turbojet and the turbo-ramjet are the most economical fuel consumers up to and slightly beyond M=2. The use of a ramjet as the main powerplant can be considered only if the aircraft is intended to operate for the greater part of its life at speeds in excess of M=2.5. The most serious drawback of the ramjet—its inability to generate thrust economically at low forward speeds—can be overcome by combining the ramjet with the liquid-fuel rocket. This particular combination has the most awesome potentialities as a fuel consumer but the aircraft designer gradually is becoming accustomed to fuel flows of the order of tons per minute, and this powerplant combination may well be the ultimate for airborne vehicles. At present, however, our interest in the ultimate is necessarily academic, and over the speed range in which we are immediately interested the turbojet and the turbo-ramjet have the lower specific fuel consumptions and the more practical thrust characteristics. There can be no doubt that these powerplants, when fully developed, will be the basis of the supersonic era, just as the piston engine has been associated with the greater part of the subsonic era.

5.3 Air Intake. The characteristics of all the air-breathing powerplants are very much dependent on the pressure-recovery characteristics of the air intake, particularly at high supersonic speeds. The rapid increase of thrust with speed is achieved by utilizing the ram pressure of the air entering the intake, the velocity of the entering airstream being converted to pressure and heat. As has been noted in Section 1, the only method by which the velocity of a supersonic airstream can be reduced is by virtue of the airstream traversing a shock-wave. The supersonic air intake, therefore, relies entirely on shock-waves to convert the kinetic energy of the entering air into pressure energy, and the particular manner in which this conversion is accomplished determines uniquely the pressure recovery characteristics of the intake.

Fig. 11 shows the variation of the theoretical maximum pressure-recovery factor of three types of intake over the Mach number range. The pitot entry, with its single normal shock-wave, is the least efficient type of intake, although for aircraft which are required to operate only over a speed range up to approximately M=1.5 or 1.6 (i.e., the *transonic* fighter) its simplicity is very attractive. At high supersonic speeds, however, the multi-shock type of intake becomes essential, and Fig. 11 gives the variation of pressure-recovery factor for the two-shock and the three-shock types of intake. It is doubtful whether any intake more sophisticated than the three-shock type would yield an overall advantage, as the additional external wave-drag of the more steeply-inclined intake lips (the slope of which must match the maximum slope of the centre body) would offset any gain in thrust due to a higher pressure-recovery factor. It must be remembered that the fighter designer is concerned with obtaining the maximum net thrust from the propulsive unit (intake, engine and exhaust nozzle) and not with obtaining high intake-efficiency *per se*.

The curves given in Fig. 11 are the ideal efficiencies of the various intakes; they take no account of viscous effects (which give rise to boundary-layer growth, separation, shock oscillation, etc.) and they assume that the engine-intake combination is correctly matched, i.e., that the air "collected" by the intake is always of exactly the right amount to satisfy the demands of the engine at that particular flight condition. The curves further assume that at any Mach number the intake configuration is such that the shock-waves from the centre body correctly impinge on the intake lip, i.e., that no spillage is occurring. These problems of viscous effects, of engine-intake matching and of variable shock configuration render the design of a satisfactory intake the most difficult single aerodynamic problem which must be overcome in the creation of a supersonic aircraft.

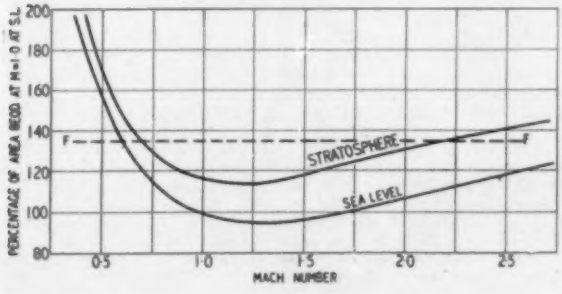
Fig. 12 shows the intake area required to match the airflow characteristics of a typical turbojet or turbo-ramjet engine running at maximum r.p.m. Ideally the intake design should be such as to allow the entry area to be varied to suit conditions at any point between or on the curves given in Fig. 12, which indicates that the intake geometry must permit a 40 or 50 per cent variation of entry area. Alternatively, if the intake is of fixed geometry having an entry area represented by the line marked FF on Fig. 12, then a by-pass must be incorporated so that the excess air taken in at any speed where the intake is not matched to the engine can be spilled from the duct at some point upstream of the engine entry face. Unless this excess air is spilled overboard with some care relatively severe drag penalties can result.

In order to eliminate spillage drag and to minimize the cowl wave-drag it is necessary for the shock-waves emanating from the centre body to impinge on the intake lips. For this condition to obtain at all flight speeds it will be necessary to move the centre body forward relative to the intake lips as the flight speed increases. This arises because the angle of sweepback of the shock-waves increases with increase of Mach number, although for speeds in excess of M=2.0 the change of shock angle with Mach number is small.

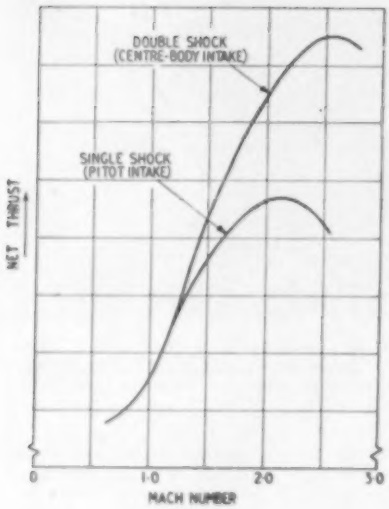
The optimum supersonic intake is thus seen to be a very sophisticated device involving great mechanical complexity, due to the requirements for varying the geometry of the intake as the forward speed is changing. The design emphasis, of necessity, will be placed on the supersonic performance of the intake; and, because of this, the subsonic characteristics are likely to be far removed from the optimum. The sharp intake lips and the sudden changes of contour, so essential for maximum pressure-recovery at supersonic speeds, are directly contrary to what is recognized as the best subsonic practice. The designer, in consequence, will be called upon to exercise great skill in compromise in order to reduce adverse losses in thrust at take-off and to avoid precipitating disastrous phenomena such as engine surge.

To emphasize the importance of intake efficiency at supersonic speeds, Fig. 13 shows how the thrust of a typical turbo-ramjet engine is affected by the type of intake employed. The curves demonstrate the very substantial gains in thrust which can be achieved by the use of multi-shock types of intake at speeds in excess of M=2.0. It should also be noted that an increase in intake efficiency will effect worth-while reductions in specific fuel-consumption.

Fig. 12. Variation of optimum intake area with speed and altitude for typical turbojet or turbo-ramjet.



5.4 Altitude Effects. The effect of altitude on the performance of the rocket motor is beneficial in that, due to the reduction



THE SUPERSONIC FIGHTER . . .

Fig. 13 (left). Effect of intake efficiency on the thrust of a turbo-ramjet engine (stratosphere).

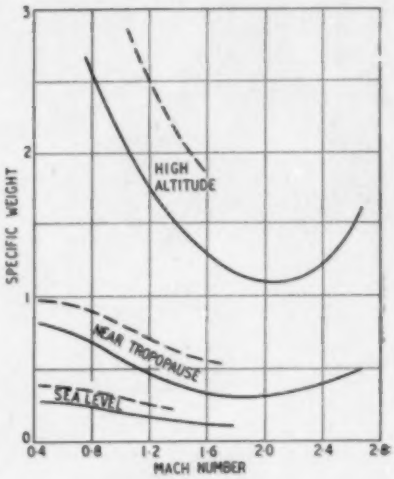


Fig. 14. Variation of powerplant specific weight with Mach number and altitude. Turbo-ramjet, continuous line; turbojet, broken line. Specific weight (lb/lb) = total powerplant weight ÷ net thrust produced.

of atmospheric back-pressure the thrust will increase with increase of altitude. The reduction of ambient pressure with increase of altitude, however, reduces the net thrust of the air-breathing types of powerplant at constant flight Mach number. In the stratosphere at constant forward speed the s.f.c. of each of the three types of air-breathing powerplant is sensibly independent of altitude, and the net thrust is directly proportional to the ambient pressure. This means that the efficiency of these powerplants, measured in terms of the amount of thrust produced by a given weight of engine, decreases as altitude is increased. This is illustrated in Fig. 14, which gives values of engine specific weight (= gross weight of engine ÷ net thrust) for typical turbojet and turbo-ramjet engines. On this basis of comparison, note the superiority of the turbo-ramjet at all altitudes, and the marked deterioration of the specific weight of both types of powerplant with increase of altitude.

5.5 General. It is possible, using values of engine specific weight from Fig. 14 and values of L/D ratio for a supersonic fighter from Fig. 8, to obtain an appreciation of the powerplant weight necessary to achieve sustained supersonic speed in level flight.

Now, in level flight,

$$\text{Thrust} = \text{Drag}$$

and $\text{Lift} = \text{Aircraft weight}$

thus $\text{Thrust} = \text{Aircraft weight} \div L/D$

also $\text{Thrust} = \text{Engine weight} \div \text{Engine specific weight}$

Therefore $$\frac{\text{Engine wt.}}{\text{Aircraft wt.}} = \frac{\text{Engine specific wt.}}{L/D}$$

TABLE I: PERCENTAGE VALUES OF ENGINE WEIGHT ÷ AIRCRAFT WEIGHT

Altitude	Turbojet	Turbo-ramjet	Turbo-ramjet
	M = 1.5		M = 2.5
Sea level	38	22	—
Near tropopause	27	17	46
High altitude ...	35	24	27

As a further basis for assessment, the fuel flow necessary to sustain flight under the above conditions can also be calculated. The specific fuel consumption given in Fig. 10 for the turbojet and turbo-ramjet will be assumed to apply over the complete altitude range. This assumption is justified for the present approximate comparison, although in fact the s.f.c. decreases with increase of altitude up to the tropopause.

Now, $\text{Fuel flow} = \text{Thrust} \times \text{Specific fuel consumption}$

and since in level flight,

$$\text{Thrust} = \text{Aircraft weight} \div L/D$$

$$\text{Fuel flow} = \frac{\text{Aircraft weight}}{L/D} \times \frac{\text{s.f.c.}}{60} \text{ lb/min}$$

Assuming,

$$\text{Aircraft weight} = 25{,}000 \text{ lb and taking fuel at } 8.0 \text{ lb/gal},$$

$$\text{Fuel flow} \simeq 52 \times \frac{\text{s.f.c.}}{L/D} \text{ gal/min}$$

TABLE II: FUEL FLOW (GAL/MIN) IN SUPERSONIC FLIGHT

Altitude	Turbojet	Turbo-ramjet	Turbo-ramjet
	M = 1.5		M = 2.5
Sea level	144	235	—
Near tropopause	40	63	165
High altitude ...	15	23	54

The most important deduction which may be made from a study of the above tables is that the achievement of high supersonic speeds at sea level will be very costly in terms of weight. On the one hand we have the simple turbojet with a relatively low fuel consumption but of a specific weight such that the powerplant weight will be approximately 40 per cent of the aircraft weight if Mach numbers of the order M = 1.5 are to be achieved. Alternatively, we have the turbo-ramjet with a more normal ratio of engine weight to aircraft weight, but consuming fuel at a rate equivalent to approximately 7.5 per cent of the aircraft weight per minute. For these reasons (aside from kinetic heating and very high dynamic-pressure effects) it is obvious that, until the engine and airframe of the supersonic fighter become more extensively developed and refined, we are unlikely to achieve sustained speeds at very low altitude much in excess of approximately M = 1.2-1.3.

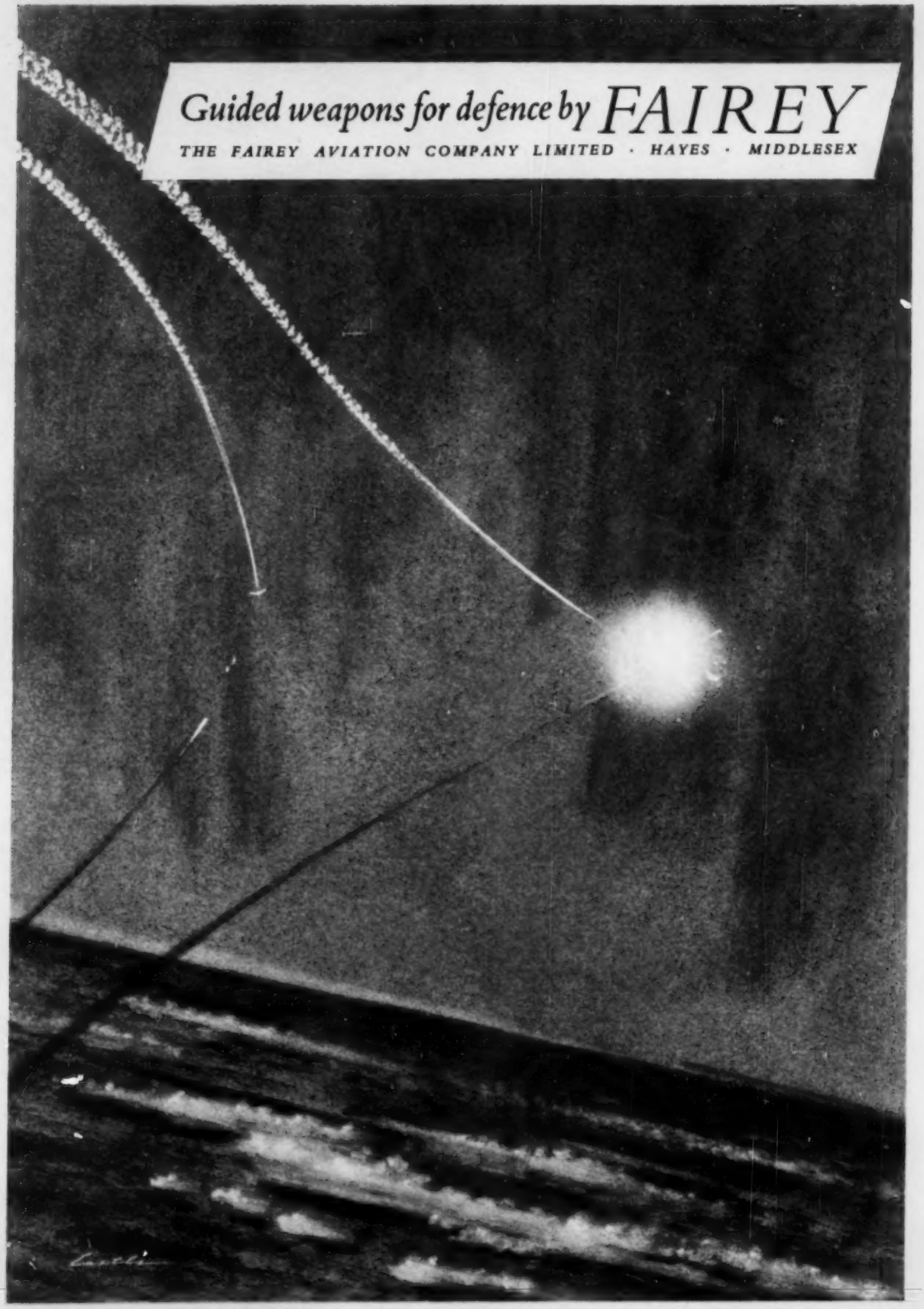
The limitations imposed by the phenomenal fuel consumptions incurred during supersonic flight are very severe, even at high altitude. As an example, consider a hypothetical fighter of 30,000 lb a.u.w., of which 25 per cent is fuel (950 gal approx.). Table II above shows that at high altitude the fuel flow is of the order of 50 gal/min at M = 2.5. Thus if *all* the fuel were to be consumed during flight at this speed and altitude, the endurance would be under 20 min. During this period the aircraft would cover approximately 500 miles—a specific air range of just over half a mile per gallon of fuel. In practice the aircraft has to climb to altitude and accelerate to M = 2.5, and the quantity of fuel subsequently available for steady flight at such speeds will limit the endurance under these conditions to a few minutes.

Such brief penetrations to very high speeds do not make the designer's task easier, particularly with regard to the effects of aerodynamic heating on the structure of the aircraft. These effects become extraordinarily difficult to estimate, due to the transient nature of the conditions. N. J. Hoff pointed out some time ago* that, to ensure an adequate safety margin, future aircraft may have to be regarded as expendable after a certain number of penetrations to very high speeds, due to the extreme difficulty of assessing the effects on structural strength and stiffness of transient heating to high temperatures.

The question of which type of powerplant should be adopted in a particular case cannot be resolved by the relatively simple arguments advanced above, which are intended merely to illustrate the effects of the more significant factors. The ultimate choice of powerplant (assuming equal availability of the different types) is dictated almost wholly by the particular mission which the aircraft is required to accomplish. Unfortunately, security regulations do not permit the discussion of this class of data so that, on this subject of choice of powerplant, no further generalizations are possible.

(To be concluded)

*"Structural Problems of Future Aircraft." N. J. Hoff, R.Ae.S.—I.Ae.S. Conference, Brighton, 1951.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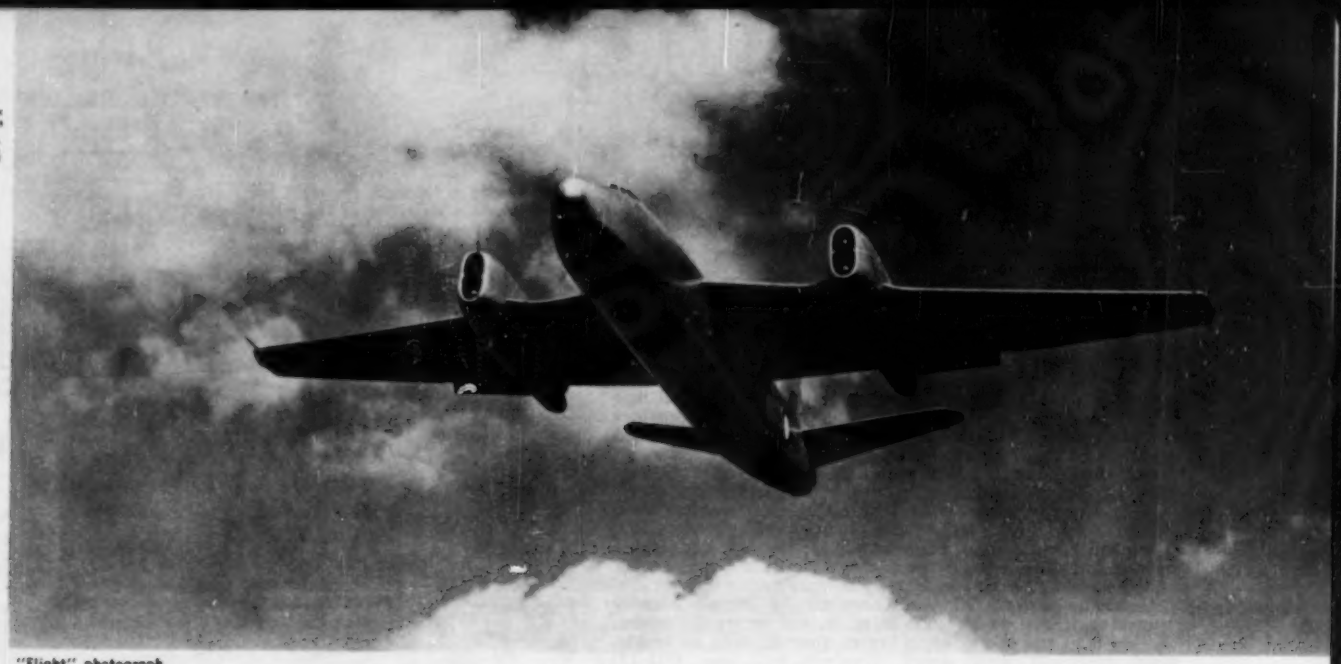
UNDER INTENSIVE
DEVELOPMENT FOR
SUPERSONIC AIRCRAFT

GYRON



"Flight" photograph

The first prototype S.A.4 Sperrin, showing the pairs of superimposed engines.

SHORT SPERRIN

Noteworthy Features of a British Four-jet Bomber Design

THE fourteenth official specification for the year 1946 was intended to produce a jet-propelled successor to the Lincoln, which was then the standard heavy equipment of Bomber Command. Short Brothers and Harland, Ltd., submitted a design to the specification, in the form of a shoulder-wing machine powered by four of the new Rolls-Royce axial-flow Avon turbojets mounted in unusual double-banked nacelles, the jet-pipes passing above and beneath the wing.

The resulting aircraft received the company designation S.A.4 —and has recently been named Sperrin, after a lofty mountain range dividing the counties of Londonderry and Tyrone (by coincidence a picture of these mountains appeared in the December 10 issue of our associated journal *The Autocar*). The specification called for a medium range, good altitude performance and a crew of five. Design went forward from 1947 until the first prototype flew on August 10th, 1951. Another prototype was completed shortly afterwards, and yet a third airframe was built for structural testing. The development and testing of this aircraft has been accompanied by a most extensive research programme, many of the results of which are manifest in the Sperrin today.

Last week the Ministry of Supply relaxed the security restrictions which had until then applied to the Sperrin, and we have accordingly prepared the accompanying drawings and the following account of the principal features of the aircraft. No one would pretend that the Sperrin is a beautiful machine to look at, or that it represents the latest thought in bomber design. On the other hand, it is the newest aircraft of its type about which anything approaching a full description can be published, and the following notes are accordingly of considerable interest.

Airframe. The structure of the Sperrin is a conventional stressed-skin, light-alloy assembly, in which a number of processes developed by the manufacturers—such as hot dimpling and rivet-head milling—have resulted in external finish of a very high order.

The fuselage consists of nose, centre and tail sections, but is built as a unit. The nose section incorporates a crew compartment and a nose tunnel for the air bomber, all of which are pressurized to 9 lb/sq in. The centre fuselage carries four heavy transverse booms, to which the port and starboard mainplanes are attached. The tail section carries the fin and dihedral tailplane.

The mainplane has a torsion-box spar, and is tapered in plan, with a slight overall angle of sweep-back. Between the fuselage and the nacelles, and between the latter and the ailerons, are fitted four simple flaps, the outer units incorporating split air-brakes which open above and below the trailing edge. The flaps and air-brakes are operated hydraulically, an independent system being provided to lower the flaps to 40 deg in emergency.

The tail unit is quite conventional. The cockpit has dual controls, connected by cable and roller chain to screw-operated servo tabs on the trailing edges of the control surfaces (including the ailerons), the tabs moving the latter aerodynamically without the need for any additional power assistance. Automatic injection of "feel" is provided, and the cable runs are fitted with automatic tensioners to compensate for changes in temperature. The elevator control also incorporates a g-restriction unit which applies a load opposing the pilot's stick-force when the vertical acceleration imposed on the aircraft reaches a pre-determined magnitude.

Power Units. Each wing carries a pair of Rolls-Royce Avon RA.3 turbojets mounted one above the other in a triangulated tubular structure attached at four points to built-up fittings in the region of the front spar girder. Each Avon is secured by spherical bearing-blocks, two on each side, and the joint between the mounting and the wing is held by double-ended bolts, conical bushes and expanding sleeves.

The lengthy jet-pipes are carried on guide rails above and below the wing (the structure of which is continuous through the nacelles), the large, substantially unstressed nacelles fairing the entire installation. In the nacelles, the powerplant space is subdivided by vertical and horizontal firewalls, as shown in the drawing at the top of p. 873. Each Avon is connected, *via* a universally-jointed shaft, to a Rotol accessory gearbox mounted in the swept-forward fairing to the leading edge of the wing where the latter meets the nacelles. Each gearbox carries a supercharger for the cabin air system, two D.C. generators for the electrical system and two pumps for the hydraulic system. The Avons have self-contained lubricating systems of the wet-sump type. P-type electric starter motors are used, faired by a nose "bullet" on each engine.

Undercarriage. In our Farnborough Report Number for 1951 we referred to the "towering undercarriage" of the S.A.4, terming it "an impressive piece of engineering." Of British Messier design, it consists of a steerable and castoring two-wheel nose unit and a pair of four-wheel bogies with a track of 32ft 2in.

The three units are raised and lowered together by the main 4,000 lb/sq in hydraulic system, the nose unit retracting to the rear through twin doors into an unpressurized box in the forward fuselage, and the main units folding inwards to lie between the wing spars inboard of the nacelles. A safety device consisting of a ram-air pressure switch is inserted in the circuit to the electric/hydraulic selectors to prevent retraction until the aircraft is flying at a predetermined airspeed. The selectors are housed in the bomb-bay and are controlled by a push-button unit mounted on the right-hand side of the first pilot's instrument-flying panel.

The nose unit is hydraulically steerable from the aileron hand-wheels, though not until a hydraulically operated clutch has been engaged by operating an on/off switch on the flying-control-lock panel forward of the power levers. With the clutch disengaged, the nose wheels are free to castor.

SHORT SPERRIN . . .

The tyres, wheels and brakes are by Dunlop. The tyres of the nose unit are of 30 × 9.00-15 size (98 lb/sq in) and the main-wheel tyres are size 35 × 10.00-17 (105 lb/sq in).

The main bogies are fitted with multi-plate brakes, operated by levers on the main aileron-control wheels. A small hydraulic transmitter at the base of each control column operates a brake differential unit, connected into the rudder control lines on the starboard side of the bomb-bay *via* a static pipeline which is not connected to the main hydraulic supply. The brake pressure is applied by the pilots' hand levers, the differential pressure being controlled by the extent to which either of the rudder pedals is pushed forward. The main supply-pipe to the differential unit is also connected to a hydraulic accumulator, which provides enough capacity for six full applications of brake pressure (based on 1,000 lb/sq in) for emergencies or during ground tests with power off; thereafter, pressure must be obtained from an electrically driven emergency pump or from the hand-pump.

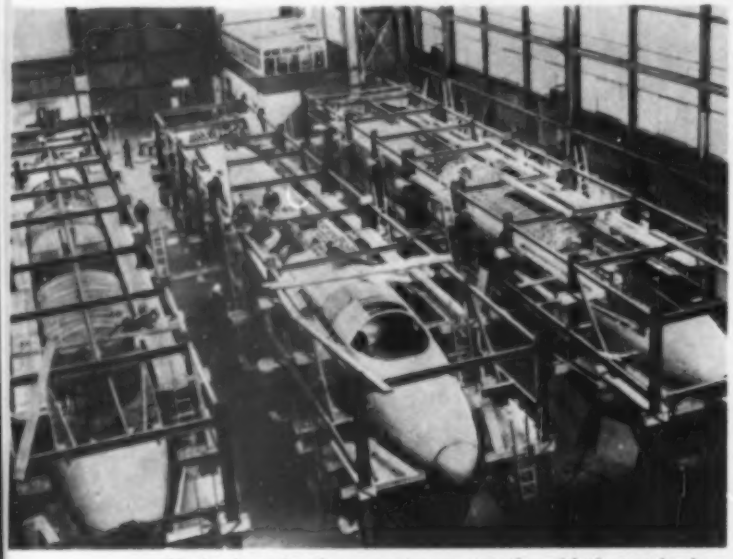
Each brake assembly is fitted with a Maxaret unit. This is energized from the "u/c down" circuit *via* a small hydraulic transmitter which ensures that, while the Maxaret unit is free to operate as soon as the main bogies are lowered, the main wheels cannot be locked by inadvertent application of brake during flight.

Hydraulic system. This is energized by British Messier pumps to a pressure of 4,000 lb/sq in, and serves the undercarriage (legs and doors), wheel brakes, steering, flaps, air brakes, bomb doors and camera doors. Hydraulic fluid (spec. OM-15) is stored in a pressurized tank with a capacity of 3½ gal normal system, 2½ gal emergency system and 3 gal air space. This tank is located above the mainplane drag sheeting in the fuselage, so providing a head for the pumps.

Two pumps, operating in parallel, are mounted on each of the two accessory gearboxes in the wing leading edges. The pumps are of the positive-displacement plunger type, and they operate continuously under the control of a cut-out valve which maintains the system pressure between 3,500 and 4,000 lb/sq in.

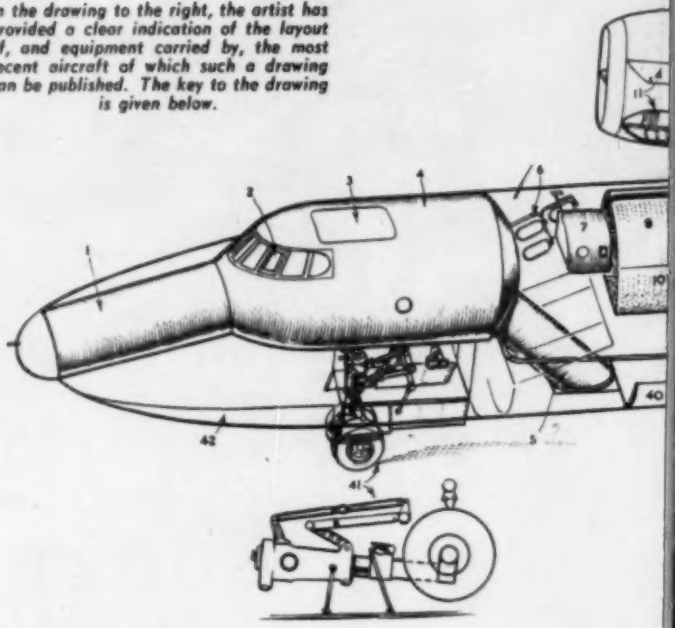
The undercarriage system has already been described. The flaps are operated by a swinging-rod system moved by a single large jack in each wing, each jack having three compartments giving flap deflections of 7 deg, 25 deg and 40 deg. The two latter positions are obtained by selection of the appropriate value on a sprung lever mounted alongside the engine power levers and working in a quadrant gated at the take-off position. This lever governs an electric/hydraulic selector mounted in the bomb bay. The 7-deg flap position is obtained by depressing a switch on either of the control-column handwheels.

The circuits for the bomb and camera doors are so arranged that, although both sets of doors open together, shutting the doors to the bomb-bay leaves the camera doors open. The latter are then closed by operating a separate switch which also enables the camera doors to be opened and closed independently. The electric/hydraulic selectors for the air-brakes are controlled by a switch on the throttle box. The air-brake jacks are fitted with



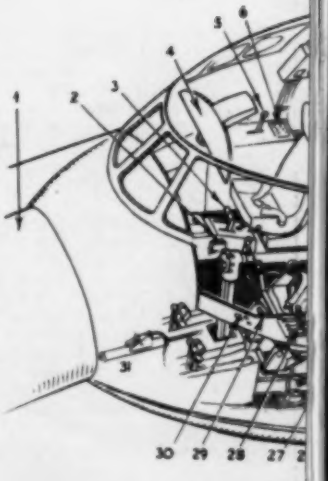
The fuselages for the two prototypes, together with the test fuselage, are seen here in their production-type jigs at Belfast. Had the type been ordered in quantity, these jigs would have saved many months.

In the drawing to the right, the artist has provided a clear indication of the layout of, and equipment carried by, the most recent aircraft of which such a drawing can be published. The key to the drawing is given below.

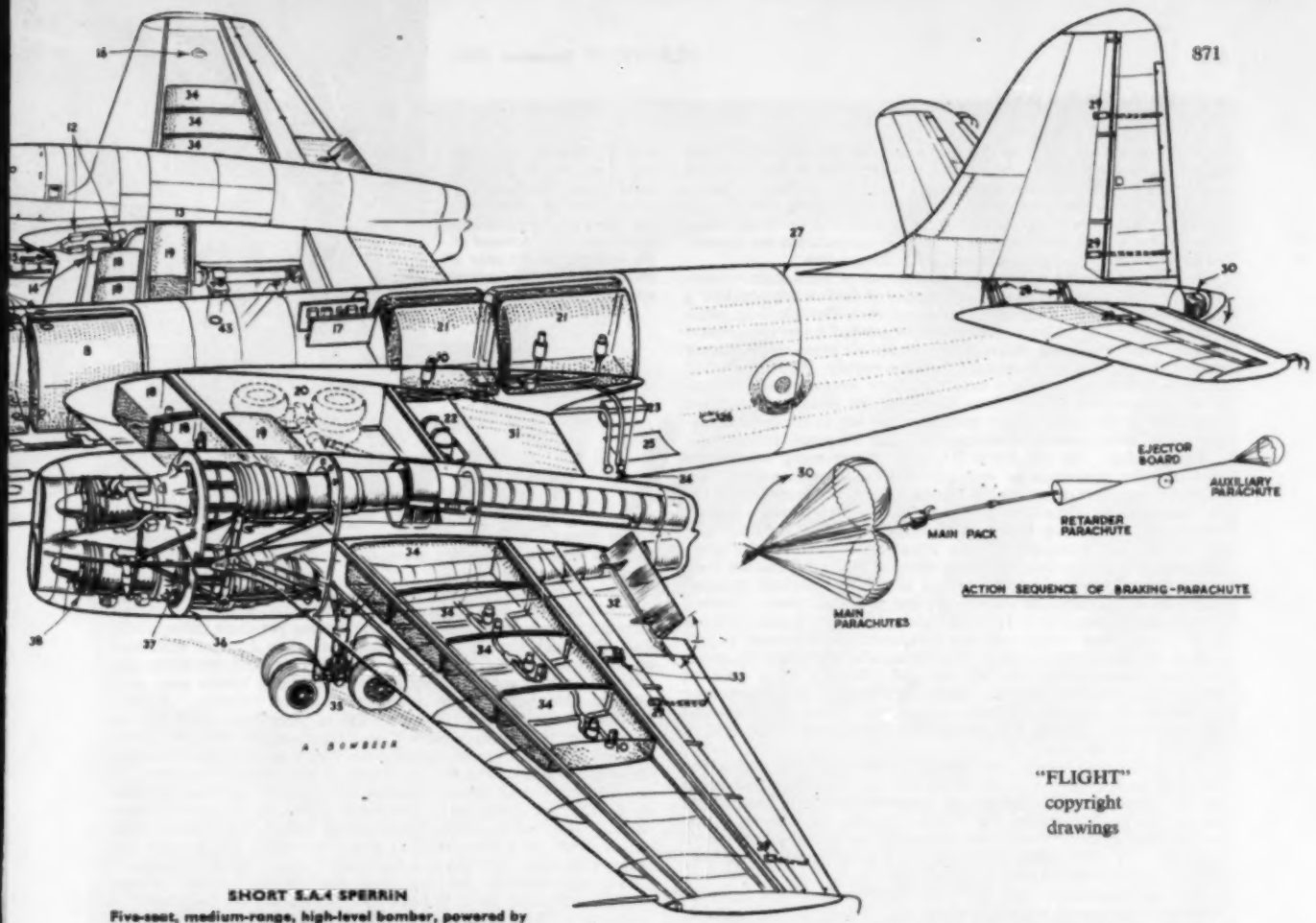


1 Air bomber's prone position
2 Direct-vision window
3 Pilot's escape hatch
4 Pressurized crew compartment
5 Normal entrance and escape tunnel
6 Oxygen bottles
7 H-type Mk 3 dinghy
8 Fuel 800 Imp. gal
9 Fuel cut-offs and emergency fillers
10 Refuelling valves
11 Engine access panels
12 Generators and suppressors
13 Cooling-air for 12
14 Pressurization pack driven by accessory gearbox
15 Air-intake to 14
16 Taxying lights
17 Electrical control and contactor panels
18 Fuel 277 Imp. gal
19 Fuel 280 Imp. gal
20 Main-undercarriage bay
21 Fuel 690 Imp. gal
22 Fuel recuperator
23 Accumulator bay
24 Refuelling points
25 Aerial hatch
26 Signal discharger
27 Transport joint
28 Tailplane and fin mounting frames
29 Servo-tab screw-jacks (all control surfaces similar)
30 Braking-parachute stowage (see inset)
31 Inner flap section
32 Outer flap section and air brake
33 Actuator for servo tab
34 Fuel 1,053 Imp. gal in each wing
35 British Messier main undercarriage with Dunlop tyres, wheels, brakes and Maxaret units
36 Vertical firewalls
37 Horizontal firewall
38 Four Rolls-Royce Avon RA.3 turbojets
39 Cabin-pressurization line, silencer and spill valve
40 Bomb-bay doors
41 Rearward-retracting nose undercarriage
42 Radome
43 Hydraulic filler

This drawing shows the neat layout of the spacious flight deck. The first-pilot's ejection seat is forward to port, and the signaller, navigator and air bomber sit behind, facing aft. Out into the nose stretches the tunnel to the air bomber's over-target position.



1, Radar access tunnel, air bomber's prone position; 2, braking parachute stream switch; 3, engine power levers; 4, top panel for fire-warning lights and extinguishers; 5, bomb door emergency control; 6, refuelling switches; 7, bomb selector box; 8, air bomber's normal station; 9, hinged navigator's seat and upward-hinging plotting table; 10, ejection seat spring-loaded cable; 11, air bomber's and navigator's oxygen economizers; 12, manual dinghy release; 13, external dinghy release; 14, dinghy stowage; 15, generator control panel; 16, pressure door seal; 17, entry hatch; 18, hatch emergency release and jettison linkage; 19, navigator's seat hinge lock; 20, signaller's seat; 21, first-aid stowage; 22, flap and undercarriage emergency levers; 23, ejector-seat hydraulic bracing strut and damper; 24, crew-escape emergency lever; 25, g-restrictor; 26, 1st pilot's oxygen; 27, engine-starting panel; 28, relighting switches; 29, pilot's emergency escape control; 30, bomb-jettison switches; 31, control-column clearance latch.

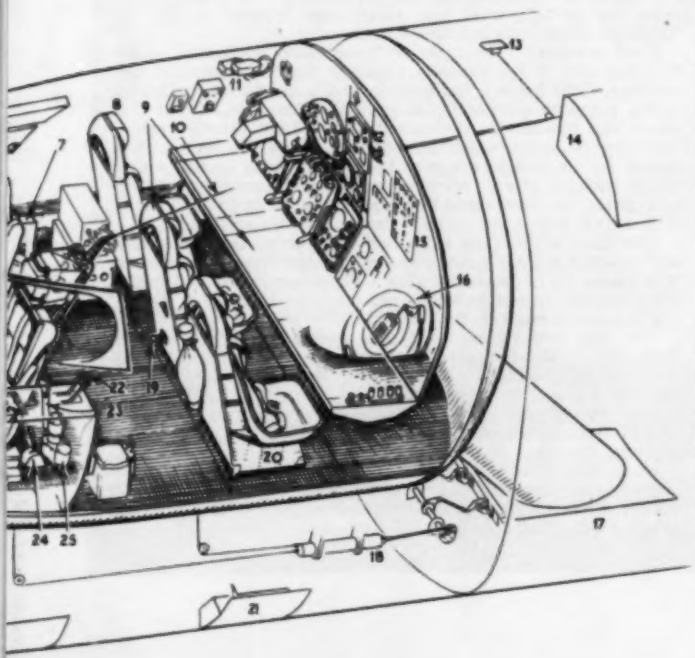


"FLIGHT" copyright drawings

SHORT S.A.4 SPERRIN

Five-seat, medium-range, high-level bomber, powered by four Rolls-Royce Avon RA.3 turbojets of 6,500 lb each.

Span, 109ft; length, 102ft 3in; height, 28ft 6in; track, 32ft 2in; wheelbase, 30ft 4in; distance between centre-lines of engines, 40ft 6in. Wing aerofoil section, A.D.7; aspect ratio, 6.27; incidence, 4 deg 30 min; dihedral, 1 deg; gross area, 1,896 sq ft; flap area (aft of hinge), 230 sq ft; ailerons (aft of hinge), 104.5 sq ft; servo tabs, 19 sq ft; air brakes, 62.7 sq ft. Tailplane span, 42ft; dihedral, 13 deg; total horizontal tail area, 364 sq ft; elevators (aft of hinge), 98 sq ft; tabs, 14.8 sq ft. Fin and rudder area (excluding dorsal fin), 156 sq ft; rudder aft of hinge, 51.2 sq ft; tab area, 3.7 sq ft. Normal all-up weight, 115,000 lb; design ultimate factor, 4.0; wing loading, 60.6 lb/sq ft; internal bomb bay volume, 996 cu ft; maximum normal bomb load, 20,000 lb; maximum normal fuel capacity, 6,200 gallons. Maximum level speed, 490 knots (564 m.p.h.) at 15,000 ft; maximum cruising speed, 435 knots at 40,000ft; design diving speed, 390 knots e.a.s.; design maximum Mach number, 0.85; operational range in still air with 10,000 lb bomb load, 3,350 nautical miles (3,860 statute miles) with over-target height of 45,000ft.



mechanical locks which hold the control surfaces in the "normal flight" position; the jack circuits are also fitted with restrictors which restrain the speed of operation and prevent the air load on the brakes from extending the jacks too rapidly and causing cavitation.

Electrical system. The basic system operates at 24 volts D.C., power being supplied by four parallel-connected P.3 generators driven from the gearboxes, each having an output of 200 amp at 30 V. Four Type C (12 V, 40 amp-hr) accumulators are used, connected in series/parallel, together with four Type 23 remotely trimmed voltage regulators and four B.T.H. differential cut-out switches.

Supplies of 400-cycle, three-phase 115 V current for the G4B compass and artificial horizon are obtained from a pair of Type 100A inverters mounted on the starboard side of the forward entrance hatch. Another system provides all the electrical power, other than 24-V D.C., required by the radio and radar installations. It consists of two Type 201 inverters with electronic voltage regulators, two Type 103 inverters with Type 15 control panels, and a Type 1000 rotary transformer, all these units being located immediately behind the pressure cabin. Each inverter provides a 115-volt supply, the Type 201 at 1,600 cycles, single-phase (for such items as radio altimeter, N.B.C., H_2S, tail-warning radar, Rebecca and Gee) and the Type 103 at 400 cycles, three-phase (for H_2S, N.B.C., cabin-pressurization controls, tail-warning radar, Gee and A.R.I. 5332 H.F.). The rotary transformer supplies the D.C. 112-volt supply required by the H_2S.

The electrical system of an aircraft of the nature of the Sperrin is, of course, of immense complexity, and the wiring diagrams necessary for servicing the equipment occupy almost 100 sheets. Some of the services supplied by the basic D.C. system include control of the hydraulic lines for the undercarriage, flap, bomb-door and other systems (with all the attendant safety devices), flap and air-brake interlocking, control-surface locking (each control surface is centralized and there locked by an opposed-thread screw-jack driven by an electric actuator, a corresponding lock on the engine power lever box permitting the Avons to be opened up one pair at a time for ground-test purposes), fuel-pump motors, engine starting, pump isolation and fuel cross-feed, alighting-services indicators, fire warning and extinguishing, emergency hydraulic pump power, and signal discharger.

Fuel system. The Sperrin has 22 non-rigid fuel tanks, seven

SHORT SPERRIN . . .

in each wing and eight in the fuselage. As shown in the large drawing, the four tanks in the inner-wing leading edge and the eight tanks in the fuselage are coupled together in pairs. Smiths Waymouth contents gauges are installed, and the system is normally fuelled from either of two sockets, in the sides of the fuselage to the rear of the bomb-bay. These connections are housed in boxes beneath the skin, covered with hinged lids.

A fuel recuperator is provided to the rear of each main undercarriage well, to maintain a steady supply of fuel under negative-g conditions. Each recuperator consists of a flexible bag pressurized to 6 lb/sq in by a bleed from the second Avon compressor stages. This bag then delivers fuel under air pressure whenever the booster pumps cease to pass a positive supply. The engine fuel systems are those normally fitted to early Avons—perhaps surprisingly, even the earliest Avon cannot yet be described—and the capacities of the tanks can be read from the key to the large drawing. The total maximum tankage is 6,200 Imperial gallons.

Lubrication. As the Avon RA.3 has a wet-sump lubrication system, the powerplants are virtually self-contained in this regard—and, therefore, no full description is yet permissible. Oil is contained in close-fitting sumps beneath the centre-section wheelcase, each sump having a capacity of about 17 pints. The oil coolers are mounted on the lower port sides of the compressor casings, the cooling being effected by high-pressure fuel.

Fire protection. As the drawing of the powerplant installation shows, the cowlings are divided into fireproof zones. Zone 2 houses flame-switches 1 to 8 and zone 1 houses flame-switches 9 to 15, all these being connected between the electrical supply and earth *via* a warning lamp. In each nacelle, alongside the lower jet-pipe immediately behind the rear firewall, is a pair of extinguisher bottles, operated either by a cockpit push-switch or by an inertia switch. These bottles feed spray rings around the compressor casing, turbine section and on the front face of the rear firewall.

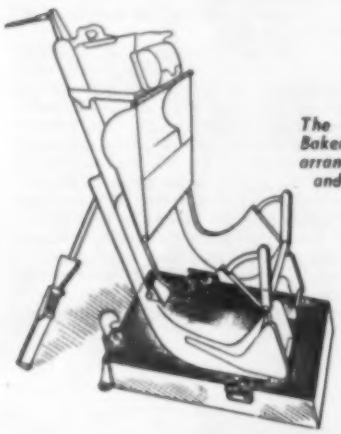
Six additional bottles are fitted in the fuel-tank bays, one being in each inner and outer wing and the remaining pair being in the forward and aft fuselage bays. These are discharged either by push-switches, by flame-switches or detectors (the latter being of the pyrotechnic-cord capillary type), or by inertia switches. If the inertia switches are closed, current is drawn from a separate accumulator-fed supply.

Air conditioning. The crew compartment of the Sperrin, together with the nose tunnel for the air bomber, is pressurized to a maximum differential of 9 lb/sq in, and provision is also made for ventilation, temperature control, humidity control and window de-misting. The system includes 20 Normalair units.

For pressurization and ventilation, air is obtained from two Godfrey Marshall-type superchargers mounted one on each accessory gearbox in the leading edge of each wing. These blowers are of the two-stage type, the first stage being in operation up to an altitude of approximately 22,000ft, above which both stages operate. Supercharger air is obtained from a ram intake in the wing leading-edge, which embodies a rain trap and filter, the latter also incorporating a relief valve, which, in the event of damage to the intake, prevents overheating of the first blower stage.

Having passed through the first supercharger stage, the air is put through the primary cooler before entering the second stage. From the second stage the air is ducted along the leading edge of the wing to the silencers which are installed in the bomb bay. It next passes the spill valves, which are so situated that spilt air assists heating of the bomb-bay; it is then taken into the pressure cabin *via* a non-return valve.

Once inside the cabin, port and starboard systems supply a common duct through a choke valve, the latter being used in conjunction with a temperature-control valve. A by-pass valve is fitted forward of the choke, and the air can then be taken



The first pilot uses this Martin Baker ejection seat, which is arranged to hinge slightly inwards and to the rear before ejection.

British Messier designed the Sperrin's undercarriage, the towering main units of which retract hydraulically into the inner wing. Just forward of the housing can be seen a dive-recovery flap which was not, in fact, used in practice.

either directly into the crew-space, or passed through a Godfrey cold-air unit or through a secondary cooler forming part of the cold-air unit.

Control is achieved by means of a pressure/static head in the duct, calibrated for a given mass-flow and which, operating through a mass-flow controller, transforms pressure differentials into electrical signals. These impulses then control actuators on the main spill-valves. From the metering duct the air is discharged into a space beneath the cabin floor which acts as a plenum chamber for the whole pressurized volume. A proportion of the air is ducted forward to supply a jet of dry air directly to the cabin windows and bomb-sight; this air is not affected by action of the humidifiers, which are installed between the metering duct and the discharge to the plenum chamber.

The pressure controller maintains the cabin pressure altitude at 8,000ft by operating a discharge valve at the rear of the cabin. This valve, which incorporates safety and inward-relief valves, leads to a duct which carries the waste air through the bomb-bay, thus utilizing any available heat. The air eventually passes out through the rear bulkhead of the bomb-bay and through extractor ports in the fuselage beneath the tailplane.

Oxygen. The equipment of the Sperrin makes provision for either normal economizer breathing or pressure breathing, but conversion requires a certain amount of ground servicing.

Four Mk 10A cylinders are mounted on the sloping floor just aft of the pressure cabin on the starboard side; they can be charged *in situ* through a line valve. From another line valve, the oxygen passes to the port side and then forward under the pressure cabin, which it enters just behind the first pilot's seat. The pipe connects with another line valve just beneath the floor, and then goes on through a line filter to regulator units, one below each side of the instrument panel, and thence aft through line filters to regulators at the crew stations. Each regulator is connected through a selector valve to an economizer and mask. A cut-off valve is fitted in the line between the regulators for the navigator and air bomber. A T-piece provides for an additional line which runs forward to the air bomber's visual bombing station in the nose.

Crew stations. The main entrance hatch is situated under the rear end of the pressure cabin in the flat bottom of the fuselage. The hatch is jettisonable, and it incorporates a ladder giving access to a tunnel with an inset ladder which leads forwards and upwards to the circular door of the pressure cabin. This door hinges outwards and upwards, assisted by springs; it is locked by six plungers operated by a cam ring turned either by an external geared wheel or an internal hand-grip, and, in emergency, can be released by movement of the centre crew-seat. The door is sealed by a rubber ring inflated by hand pump.

The main windscreen is formed from seven castings bolted edge-to-edge to form a semi-circular horizontal row of ten panels. The panes are of laminated glass with an extended vinal (polyvinal butyral) interlayer which picks up the frames. A direct-vision panel is fitted on the port side.

The first and second pilots sit side-by-side on the broad flight-deck. The first pilot is the only crew-member provided with an ejection seat. This is so mounted that the chassis carrying the seat guide-rail is pivoted laterally to the floor. A control lever on the port side is arranged to jettison a roof hatch and tilt the seat slightly inboard and aft for ejection through the resulting opening.

The second pilot, to starboard, and the wireless operator, navigator and air bomber (respectively to port, centre and starboard on the rearward-facing desk behind the pilots), all have conventional seats, that for the navigator being capable of being

Safe ejection

50 ft.

500 knots.

LOW EJECTION AT CHALGROVE

To determine a minimum altitude at which a safe ejection is practicable, with their latest Fully Automatic Ejection Seat, the Martin-Baker Aircraft Company conducted air tests at Chalgrove Airfield, Oxfordshire, on 29th August, 1954.

During the tests an ejection was made from a Meteor aircraft flying at 500 knots at the remarkably low altitude of 50 feet. The ejection was completely successful, the main parachute being fully deployed before the dummy alighted without damage.

This astonishing feat was made possible by the employment of two stabilising drogues in tandem, designed to reduce, with acceptable deceleration, the speed of the seat after ejection and then to control the main deployment of the parachute thus eliminating the explosive opening characteristic. This seat was also fitted with the Martin-Baker Patent Barostatically Controlled Time Release Mechanism and Drogue Gun.

With this arrangement automatic separation from the seat after ejection occurs with insignificant loss of height, and safe escapes near the ground are made practicable. No other ejection seat is capable of this performance.

These design features are patented in the principal countries of the world.

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ADVERTISEMENT

The flying-boat

FALLACIES AND FACTS

On the subject of water-based aircraft, expert and lay opinion is divided as upon few other aeronautical subjects. But the debate and discussion are not always reasoned and clear-cut. Too many arguments are complicated by false assumptions . . . by outdated data . . . by plain prejudice.

On this page we champion the flying-boat and challenge 'They'—all those who wittingly or unwittingly perpetuate flying-boat fallacies.

★ **THEY SAY** that the flying-boat has had its day, that it can no longer compete with the landplane.

THE TRUTH is that thanks to behind-the-scenes aerodynamic and hydrodynamic research the flying-boat has never been so well equipped to meet Britain's military and civil needs.

★ **THEY LEAVE OUT** of the question recent vital progress on the other side of the Atlantic.

THE FACTS are that in the United States, where the significance of water-based aircraft has been more fully appreciated, flying-boats are in active development and production.

★ **THEY QUOTE** facts and figures based on the performance of those grand old stagers the *Sunderland* and the *Empire Flying-boat*.

THEY FORGET that these designs are older than most National Servicemen—and as relevant to the flying-boat of to-day as the Hurricane to the Hunter.

★ **THEY ASK** why water-based aircraft, with all that is claimed for them, have been so neglected in this country.

THEY OVERLOOK the vast war-time expenditure on runway aerodromes, both here and throughout the world. It was this, short term view though it was, which kept the landplane up and the flying-boat down.

★ **THEY ARGUE** that it is now too late to revert to the flying-boat, for either military or commercial purposes.

THE RETORT is that the insistent demand for greater loads and longer ranges can only be met by bigger aircraft. While the prohibitive cost of artificial runways of sufficient length rules out larger landplanes, there is practically no limit to the size of future flying-boats. Their runways will remain as they are now—natural, free and bomb-proof.

★ **THEY THINK** only in terms of the present and the immediate future.

THEY NEGLECT the almost certain advent of atomic power for aircraft. The implications are highly important. First, only very large aircraft will be able to carry the heavy power plant and shielding. Secondly, since fuel consumption will be negligible, wing loading at landing will be high. Both these facts support the belief that atomic aircraft will have to be large flying-boats. At 140 tons, the *Princess* is their forerunner.

★ **THEY DECLARE** that flying-boats cannot operate in rough conditions and are always difficult to manœuvre and to moor.

THEY ARE IGNORANT of the vast progress made in hull design. The modern flying-boat is able to operate in almost any weather and can be virtually independent of surface craft.

★ **THEY COMPLAIN** that flying-boats are slower than landplanes.

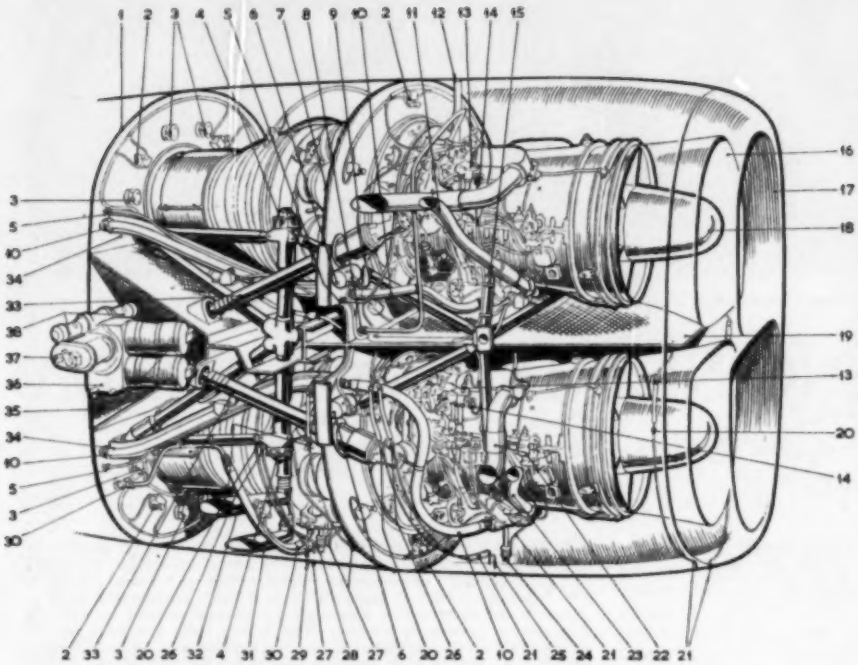
THE FACT is that the latest water-based aircraft with jet and prop-jet engines are just as fast as comparable landplanes—and offer greater range.

★ **THEY TALK** about the necessity for costly artificial basins or lagoons.

THE REALITY is that modern flying-boats can operate from natural stretches of water such as the Solent. The cost of base facilities? A fraction of that of landplane airports.

Well, which do you favour—fallacies or *FACTS?*

AN ANNOUNCEMENT BY **SAUNDERS-ROE**



The Sperrin has a most unusual engine-installation. One pair of Rolls-Royce Avon RA.3s is shown in this revealing drawing.

1, Zone 2 firewall; **2**, flame switch; **3**, flame trap; **4**, mounting; **5**, air pipe to fuel recuperator; **6**, booster coil (h.t. engine starting); **7**, Zone 1 firewall; **8**, bomb-bay heating pipe; **9**, starboard upper air bleed (upper engine); **10**, main fuel supply; **11**, starboard lower air bleed (upper engine); **12**, wheelcase breather vent; **13**, fuel-pump isolating switch; **14**, fuel low-pressure warning lamp switch; **15**, front suspension; **16**, air intake duct; **17** air intake fairing; **18**, starter motor fairing; **19**, horizontal firewall; **20**, bulkhead drain quick-release connection; **21**, bulkhead drain, zone 1; **22** and **23**, as for 9 and 11 but for lower engine; **24**, lower-engine drain (forward); **25**, upper-engine drain (forward); **26**, upper-engine drain quick-release connection; **27**, bulkhead drain zone 2; **28**, lower-engine drain (aft); **29**, upper-engine drain (aft); **30**, fire-extinguisher pipe; **31**, cooling-air discharge (lower engine); **32**, cooling-air discharge (upper engine); **33**, accessory-gearbox drive shaft; **34**, fuel-pipe heat shield; **35**, engine-driven generators; **36**, accessory gearbox; **37**, cabin supercharger; **38**, hydraulic pumps.

SHORT SPERRIN . . .

connected to the circuit which jettisons the pressure door and entry hatch. The air bomber has an alternative prone station in a cylindrical tunnel extending forward into the extreme nose above the radome. He is also provided with an electrically powered ramp which runs in rollers at the rear and on swinging links which raise the front end of the ramp during forward motion.

Military equipment. Although still subject to security restrictions, some features of the operational equipment of the Sperrin may be mentioned. The bomb-bay, occupying the entire cross-section of the fuselage beneath the wing, has a length of 30ft 3in. The bay has two large doors, of simple form, hinged to channel-section longerons and operated by hydraulic jacks. The channel member along the closing edge of each door is a light-alloy extrusion, that on the starboard door having a sprung Tufnol strip which, when the doors are closed, engages with a groove in the port door.

The second prototype Sperrin, VX 161, is fitted with provision for loading heavy weapons by means of an external crane, the cable from which can be passed through hatches in the upper fuselage decking and down into the bomb bay.

The main radar assembly is mounted beneath the nose and covered by a large removable dielectric fairing. Above the radome is the air bomber's tunnel, which—in a bomber version of the Sperrin—would normally terminate in a transparent cap and optically flat panel for visual bombing. The two Sperrins built have opaque nose-caps.

Emergency equipment. Provisions for crew-escape have already been described, the pilot ejecting through a roof hatch, after the escape of the other four crew-members through the ventral tunnel.

A Type H Mk 3 dinghy, complete with ancillary equipment, is stowed in a container in the roof of the fuselage on the port side to the rear of the cabin. It is released manually from either inside or outside the aircraft, and is automatically inflated by CO_2 pressure. Individual Type K dinghies are also provided, the first pilot having a Type J pack on his ejection seat, and the other crew-members having Type A Mk 2 seat packs. The first pilot has a back-type parachute; the remaining members have seat-type packs.

Two water/glycol hand fire-extinguishers are provided. One is located on the computor box just forward of the wireless-operator's seat and the other on the back of the second pilot's seat chassis. A signal pistol is installed in an airtight mounting on the port side of the cabin roof, just behind the pilot's ejection hatch. The pistol can be loaded, fired and unloaded without loss of cabin pressure, and, if necessary, it can be demounted and used as a hand pistol. This is achieved by "breaking" the barrel so that the entire breech-end of the pistol can be hinged upwards, so sealing off the muzzle. Other emergency equipment includes first-aid outfits, fire axes and asbestos gloves.

A braking-parachute installation is fitted in the extreme tail of the fuselage, for use during emergency landings (the Sperrin also has Dunlop Maxaret braking, mentioned earlier, as standard equipment). The installation comprises an auxiliary parachute, a retarder parachute and two main canopies, these being shown as an inset to our main drawing on pages 870-1. The assembly is streamed electrically by operating a switch housed beneath a plastic safety-cover on the port side of the engine power-lever box; the switch is moved forward to stream the parachutes, which can then be jettisoned by pressing a button mounted just in front of the stream switch.

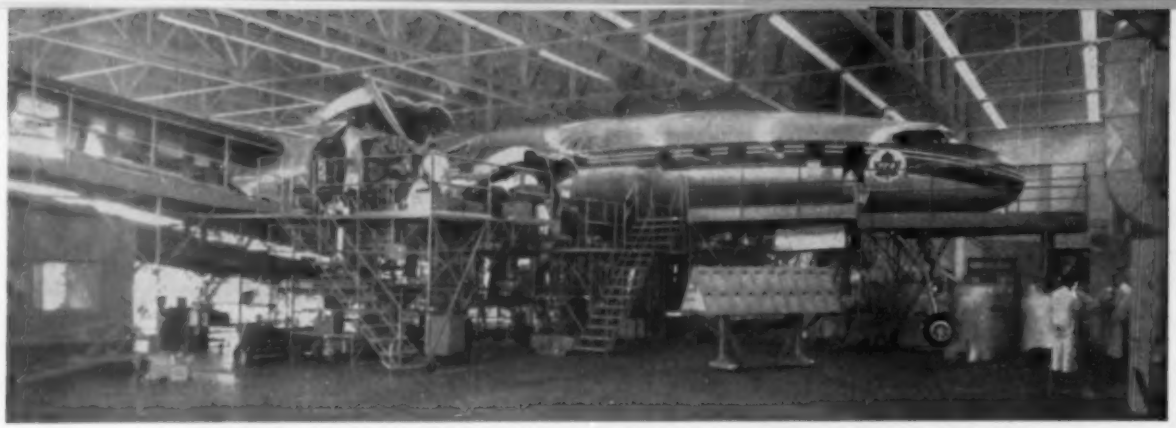
Conclusion. From the foregoing it is clear to anyone in touch with modern developments that the Sperrin is not in the same class as our present V-bombers. But one must never forget the time factor. The Sperrin was designed before any of our present medium bombers, and construction began some six years ago.

The two prototypes that were completed—and the fuselage, mainplane and tail unit used for structural testing—were all built in production jigs. This and other factors delayed the aircraft until the late summer of 1951, by which time the first prototype of the Vickers Armstrongs 660, later to become the Valiant, was also flying. As the latter was a more advanced machine, designed to a later specification, it was chosen for production. On the other hand, the Sperrin, owing to the fact that production jigging had been used from the start, could undoubtedly have been in squadron service some two years earlier; in fact, the number delivered might by now have been well into three figures.

It is in striking a balance between conflicting requirements—or, more probably, in staking all on one solution or the other—that those responsible for the purchase of new types of aircraft can profoundly affect the striking power of an air force for as much as a dozen years. We have every reason to believe that the Valiant, which is now reaching the Royal Air Force, will prove to be a world-beater at its job; and, perhaps, the Sperrin would not have been. This is no reflection on the ability of Short Brothers and Harland, whose engineering potential is as great as that of any firm in the industry. The Sperrin was designed to be capable of doing a certain job, and it met every requirement handsomely.

Both Sperrins have long been out of their manufacturer's hands. Unfortunately, nothing may yet be published of the work which they have done, and are doing, beyond reiterating the fact that one machine will shortly begin flight-testing one of our most important engines, the de Havilland Gyron—the conversion for which is being done by Shorts. Some day, however, the full story will be told, and it will be seen that, although the Sperrin itself never reached a Royal Air Force squadron, it has been instrumental in ensuring that a great many later aircraft will.

W. T. G.



Maintenance of a T.C.A. Super Constellation in one of the airline's specially designed sectional docks at Dorval.

AIRLINE ENGINEERING IN CANADA

The Organization and Work of T.C.A.'s Engineering Department

By JOHN J. EDEN, D.C.Ae.

LINKING 35 Canadian cities, flying to seven cities in the United States, to Mexico, Bermuda, Jamaica, the Bahamas, Barbados and Trinidad, crossing the Atlantic to London, Paris and Dusseldorf, Trans-Canada Air Lines have a network of routes which today covers over 19,000 miles. A total of 1,307,810 passengers were carried in 1953, and the 23 North Stars and 27 DC-3s provided 1,080 million passenger-miles at an achieved load-factor of 70 per cent.

An impressive average daily utilization of 9.75 hours on North Stars and eight hours on Dakotas was maintained last year, delay caused by mechanical faults amounting to only 1.55 per cent of the total hours flown. These results were obtained on a system spreading 3,140 miles from North to South and 6,170 miles from East to West, with airfield temperatures varying from a maximum of 105 deg F to a minimum of −50 deg F.

T.C.A. is expanding rapidly. Three Bristol Freighters were added to the fleet in 1953, and in March this year the first of eight Super Constellations was received. The first of fifteen Viscounts was being delivered last week, making T.C.A. the first airline on the American continent to operate turbine-powered aircraft.

The re-equipment programme will not only provide the additional capacity required, but is also intended to satisfy some of the increasingly specialized requirements of air transportation. Most of T.C.A.'s North Stars will be converted to 67-seat tourist aircraft for domestic services. These will be supplemented by a daily trans-continental first-class flight by 64-seat Super Constellations. A mixed tourist and first-class service is being provided by the latter aircraft on the Atlantic route, and T.C.A.'s already substantial air-freight capacity has been supplemented by the three Bristol Freighters.

The airline, which is Government-owned, has 7,000 employees, of whom 68 per cent are concerned with operations (including engineering). There are two overhaul bases, situated at Winnipeg and Dorval. The North Star and Super Constellation fleets are based at Dorval. The Merlin engines of the North Stars, and the DC-3s and their Pratt and Whitney engines are overhauled in Winnipeg, where Viscounts and Dart engines are also due to be overhauled. Test-beds for the piston engines are located in Winnipeg, where an additional test-bed with dynamometer loading is under construction at present for Dart and Merlin engines.

TRANS-CANADA AIR LINES' Viscounts, the first of which was delivered last week, are an excellent example of an airliner "tailored" to fit the operator's requirements. Co-operation with manufacturers is one important aspect of the work of an airline's engineering staff; to complete the picture, this article gives a general account of T.C.A.'s engineering outlook and work. The author, who has been closely concerned with the preparations for the introduction of the Viscount into T.C.A. service, is a project engineer on the staff of the T.C.A. engineering department.

The Bristol Freighters' Hercules, and the Wright compound engines of the Constellations, are overhauled by the Bristol Aeroplane Company in Montreal. Functional test equipment for accessories is located at both Winnipeg and Dorval. The latter also boasts "Oscar," a mobile test-bed for Merlin powerplants.

With Rolls-Royce Merlin and Dart engines, Bristol Freighters with Hercules engines, Vickers Viscounts, Godfrey Superchargers, Smith's autopilots, Lucas-Rotax fuel components, and other items, T.C.A. will be operating some seventeen million dollars' worth of British-manufactured equipment by the end of 1955. Evaluating, procuring, installing, maintaining, overhauling and developing this equipment requires close liaison between T.C.A. and the manufacturers. The airline's engineering department is the link between T.C.A. and the manufacturers as well as other airlines.

The organization of T.C.A. is as indicated in the two charts. With the increasing complexity of airline equipment and the problems associated with its selection and operation, T.C.A.'s engineering department has grown steadily from ten members in 1939 to 170 at present, including clerical and non-technical personnel.

The project engineers are the co-ordinators of all the work on their respective type of aircraft carried out by the specialized systems groups, the bulk of the organization being located at Dorval. The Viscount project engineer is located at Winnipeg, together with duplicate branches of each of the systems groups.

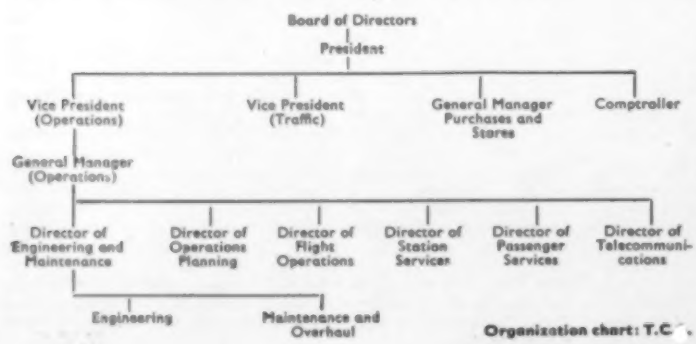
Mr. R. C. Morgan of B.E.A. has well justified the need for Airline Engineering in his recent R.Ae.S. lecture.* He has set the engineer the task of:—

(1) collecting, interpreting and weighing-up the experience of the airline,
(2) initiating action for development of safety and economy, and
(3) applying the acquired knowledge to the laying down of specifications for future equipment.

In T.C.A. these functions have been divided. An independent inspection department maintains statistical service records of equipment in current use. A quality-control section, part of the maintenance and overhaul department, investigates (on request by Maintenance and Overhaul or Engineering) problems related to irregularities or defects, follows up type trials, and checks on the functional results of introduced modifications. The findings of the quality-control section are passed, in the form of a report, to the department requesting the investigation. If necessary, recommendations are made for engineering action.

The engineering department's functions are:—

(a) To establish and improve standards to insure the airworthiness of the company's aircraft at all times.



Organization chart: T.C.A.

*"*Practical Experience of Airline Engineering.*" Reported in "Flight," April 23rd, 1954.*

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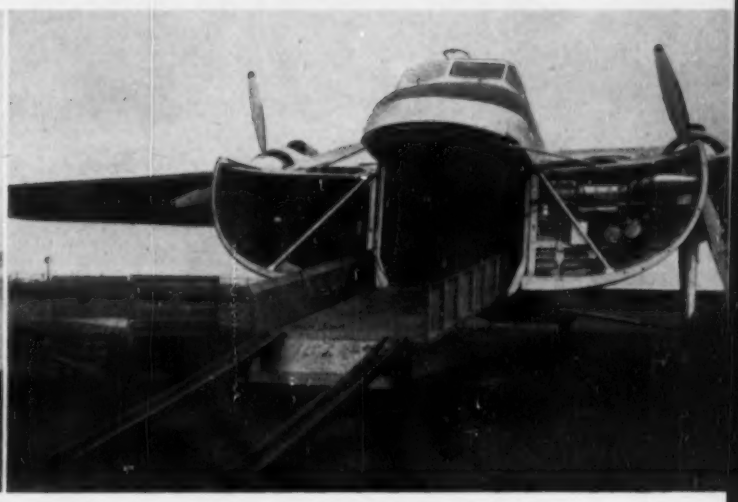


(Left) "Oscar," the mobile test-bed for Merlin engines at Dorval. Permanent test-beds are situated in Winnipeg. (Right) One of T.C.A.'s Bristol Freighters, showing the 200,000 B.Th.U. Janitrol heater installed for winter operations.

AIRLINE ENGINEERING IN CANADA . . .

(b) To act as a technical consulting body for the entire company.
(c) To perform specific engineering jobs as required.

Nearly all the efforts of T.C.A.'s engineering department are thus concentrated on the initiation of action that would incorporate into the airline's equipment certain components designed to specified standards, or bring about modifications to existing equipment to meet up-to-date requirements. The task commences with the conception of the idea and is concluded when the requirement has been successfully incorporated into the functioning of the airline.

The work involved is the result of factors that can be grouped under a number of headings:—

(1) New equipment:
  (a) Safety, acceptance standards and reliability.
  (b) Local conditions.
  (c) Standardization of equipment.
  (d) Passenger comfort and aircraft appeal.
  (e) Optimization of equipment.

(2) Equipment in use:
  (a) Maintenance of set standards.
  (b) Development.

Examples may be quoted under each of these headings:—

1 (a) *Safety, acceptance standards and reliability:* It is the task of Engineering to assure that equipment adheres to at least the strictest standards of British, American and Canadian certification requirements, although T.C.A. aims at standards of safety that are in general even more stringent. Some T.C.A. requirements on the Viscount include separate fuel systems for each engine, a two-shot methyl-bromide fire extinguisher system, an installed oxygen supply as well as portable oxygen bottles, an alternative source of static pressure, venting of the battery compartment, separation of the fuel-system wiring from the crash system, and an emergency electrical system operating from the battery.

(b) *Local conditions:* Winter conditions in Canada are severe. To determine the required modifications the Viscount aircraft was subjected to "winterization" trials in Canada, supervised by the T.C.A. engineering department. As a result, T.C.A. Viscounts are to be the first with high-energy ignition on the powerplants, and they will be using synthetic EEL 3 oil to ease starting. A 200,000 B.Th.U. Janitrol heater is being installed to augment the standard system. The engine de-icer control is being made automatic. In order to prevent ice blockage, a heat-exchanger will heat fuel prior to its entry to the low-pressure filter. Low-temperature seals and hoses are being fitted. A Nesa glass windshield will be installed, reducing icing and misting and maintaining bird-proof qualities at low temperatures, and a third windshield-wiper is being fitted. Fuselage guards will protect the fuselage from ice thrown from the airscrews. These are some of the many modifications being included by Vickers-Armstrongs to T.C.A. requirements.

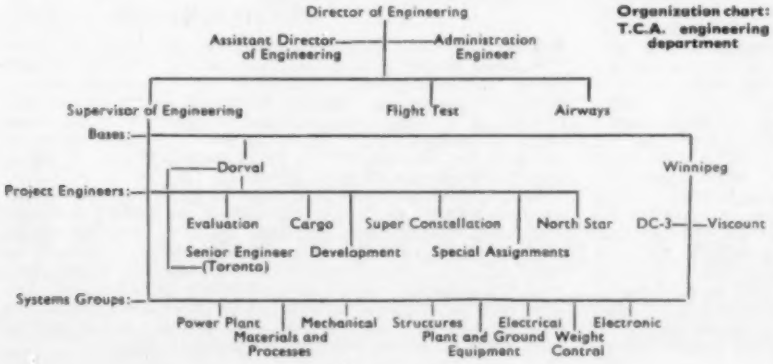
The Bristol Freighters were modified for winter operations by T.C.A. A 200,000 B.Th.U. Janitrol heater with automatic temperature-control was installed in the nose, and the fuselage was insulated with Fibreglass to protect freight.

(c) *Standardization of Equipment:* On both the Viscount and Bristol Freighter aircraft the radio systems and instrument panels were extensively modified to comply with T.C.A.'s standard arrangements, and standard American lighting systems are fitted. Thompson booster fuel-pumps on the low-pressure fuel system are being fitted on the Viscounts, as are (in order to standardize with North Stars) Godfrey superchargers. The use of this latter unit, with automatic controls developed by T.C.A., was estimated to have saved the company $400,000 during the first year in service on North Star operations.

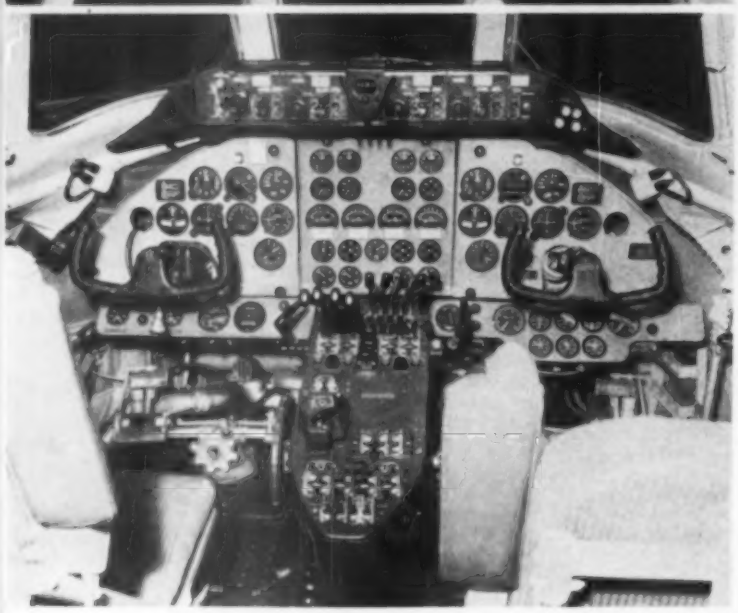
(d) *Passenger comfort and aircraft appeal:* The interior of the Viscount has been redesigned for T.C.A. with the co-operation of the New York consultant firm of Butler-Zimmermann. To bring appearances closer to the more usual style on the American continent, the interior of the cabin has been drastically re-styled. A seating arrangement of two-and-two abreast seats 48 passengers in first-class comfort. The galley design and location have been changed, and the washrooms have been redesigned. The water system has been modified to give a common system of potable water for washing and drinking; such a system was inaugurated by T.C.A. on the Super Constellation. The interior noise-level has been reduced by added thicknesses of cabin windows and additional insulation.

(e) *"Optimization" of equipment:* Major cockpit modifications were carried out by Vickers to meet the T.C.A. request that one man should be able to operate the aircraft, entirely by himself and from either pilot's seat. Automatic flame-temperature control is being provided to ease the handling of the Dart engines.

As to detail changes, some of the manufacturer's components are being replaced by lighter or more functional products,



Organization chart: T.C.A. engineering department



One of the most significant T.C.A. Viscount modifications from the crews' point of view is the changed layout of the cockpit instruments and controls. These "Flight" photographs, taken inside CF-TG1 before take-off from Wisley on its delivery flight last week, show the extremely neat American-type layout chosen.

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many of which are obtained by T.C.A. and forwarded to the manufacturer for installation. For example, a lighter and surge-free cabin-pressure control system made by AiResearch is being used.

Some test schedules for components are being revised by T.C.A. to give optimum results. Manufacturers' overhaul processes are being checked to assure compliance with T.C.A. methods. Specifications of fluids to be used are under review to give best results under local conditions.

The above are only some examples to illustrate the work involved. In all, some 200 modifications inspired by T.C.A. will be incorporated in T.C.A. Viscounts before delivery. Other airlines may avail themselves of these improvements, and at least one other airline is asking for practically all the modifications proposed by T.C.A. to be included in their aircraft. Further, the modifications carried out for T.C.A. greatly enhance the possibilities of C.A.A. certification for other aircraft similarly modified. T.C.A. has expressed its gratitude to Vickers for the wholehearted co-operation given to the airline in developing these requested modifications. Their efforts have been outstanding.

2 (a) *Equipment in Use: Modifications:* Equipment in service needs continuous attention, and action often has to be prompt. The work constantly involves the fleets of Super Constellations, North Stars, DC-3s and Bristol Freighters. Development of equipment to reduce failures, to increase overhaul periods and to reduce operating costs is part of a constant task. Modifications are checked prior to their acceptance and continuous liaison is maintained with manufacturers. The fact that this work is never complete may best be illustrated by some of the developments over the past year on as old and well-tried an engine as the Rolls-Royce Merlin. Modifications incorporated on this engine include "jet-pipe" cooling of cylinder heads, increased-capacity reduction gearing, hollow-head exhaust valves, 0.005in oversize pistons, retardation of timing by five degrees, etc. During the year, approval has been received for an extension of overhaul periods to 1,250 hours on the engine and up to 1,000 hours on blocks. Type trials at present in progress include the use of Texaco TL 1390 oil, extension of airscrew lives to 2,500 hours, use of exhaust valves made from Thomson materials, increased stem-diameter on exhaust valves, modified valve-rocker lubrication and reduction-gear pinions with skewed teeth and parallel bearing tracks. Other modifications to the North Star effecting a net weight-saving of 1,600 pounds have been incorporated during the past few years.

(b) *Development:* The North Star modification to a 67-seat layout is shortly to be carried out by T.C.A. A wooden mock-up of the modified front compartment has already been made by the airline and full radio equipment has been installed.

The modification of the powerplant to include cross-over exhausts, substantially reducing noise inside the cabin, has now been completed. The new exhaust, which is manufactured by Canadair, is a T.C.A. development.

In its function as consultant to the maintenance and overhaul department, the engineering department has advised on ground equipment needed for the overhaul of the new aircraft, and the plant and ground-equipment section has closely co-operated with the Windsor consultant firm of Giffels and Vallet in the design of the new engine test house at Winnipeg. The same section has designed the movable docks used for aircraft maintenance.

The weight section of the department keeps a continuous check on the effect of modifications on weight and prepares load-charts.

Slightly separated in function, yet part of the same department, are the flight test and airways sections. The flight test section supplies the flight operations department with all technical information for the operation of the aircraft, monitors the translation of engineering information into flight procedures and is responsible for technical flight-tests. The airways section prepares all route and airport information, keeps this up to date, and is responsible for the maintenance of the company's maps.

Future Prospects.—To determine future requirements, close contact is kept between Operations and Engineering, and provision for future aircraft and equipment is made well in advance. Continuous evaluation is carried out by the evaluation engineer, comparing the latest equipment to T.C.A.'s routes and requirements in respect to economics, performance, construction and component detail.

Looking into the future, no decrease in the steeply rising demand for air travel in Canada is apparent. There are obvious requirements for jet, turboprop and (probably using the Rolls-Royce principle rather than Convair or Lockheed techniques) vertical take-off transports. The direction in which the Canadian operator will turn to obtain the required equipment will, in view of the highly developed consciousness for sound airline economics, be solely determined by its performance.

The ease of maintenance and the length of overhaul lives of components and their number are important economic factors, particularly in a region where semi-skilled labour is rated at nearly £1 an hour.

The effect of "passenger-appeal" on airline economics has been sufficiently well demonstrated by the Viscount to justify its inclusion in the list of basic design factors. The high Canadian standard of living may accentuate the importance of this effect.

The need for concentration on the detail design and finish of components cannot be over-emphasized. The developed "modern" approach of the American continent requires that the latest proven advancements in materials be incorporated into a new component.

Geographically, Canada is the second largest country in the world. Its greatest economic expansion is occurring during the Air Age. T.C.A.'s position as the main supplier to meet this ever-increasing demand for air transportation puts high requirements on its technical staff, as well as on the suppliers who are to provide the equipment and maintain their reputation by its performance, its development and the servicing provided.

"FLIGHT" PHOTOGRAPHS

MANY of the photographs reproduced in *Flight*, i.e., those taken by our own photographic staff (as indicated on publication) are subsequently available in the form of high-quality prints. Prices are as follows (dimensions given in inches): 5½×3½, 1s 4d (glossy or semi-matt, unmounted) or 2s (toned sepia, unmounted); 6×4, 2s. 6d or 4s; 8×6, 3s 6d or 5s 6d; 10×8, 5s or 7s 10d; 12×10, 6s or 9s 8d; 15×12, 9s 6d or 13s; 20×16 (semi-matt only), 13s or 18s.

Also available are a postcard series, totalling over 200, depicting both historic and modern aircraft of the R.F.C., R.N.A.S., R.A.F. and Fleet Air Arm. Complete lists of the series are obtainable on application. Prices are 8d each card, or 7½d each for quantities of a dozen or more. One view only—in most cases a good three-quarter front or side—is available for each aircraft type. Also available as postcards, at the same prices, are reproductions of general-arrangement drawings of some 20 British aircraft that have appeared in our "Aircraft Intelligence" pages.

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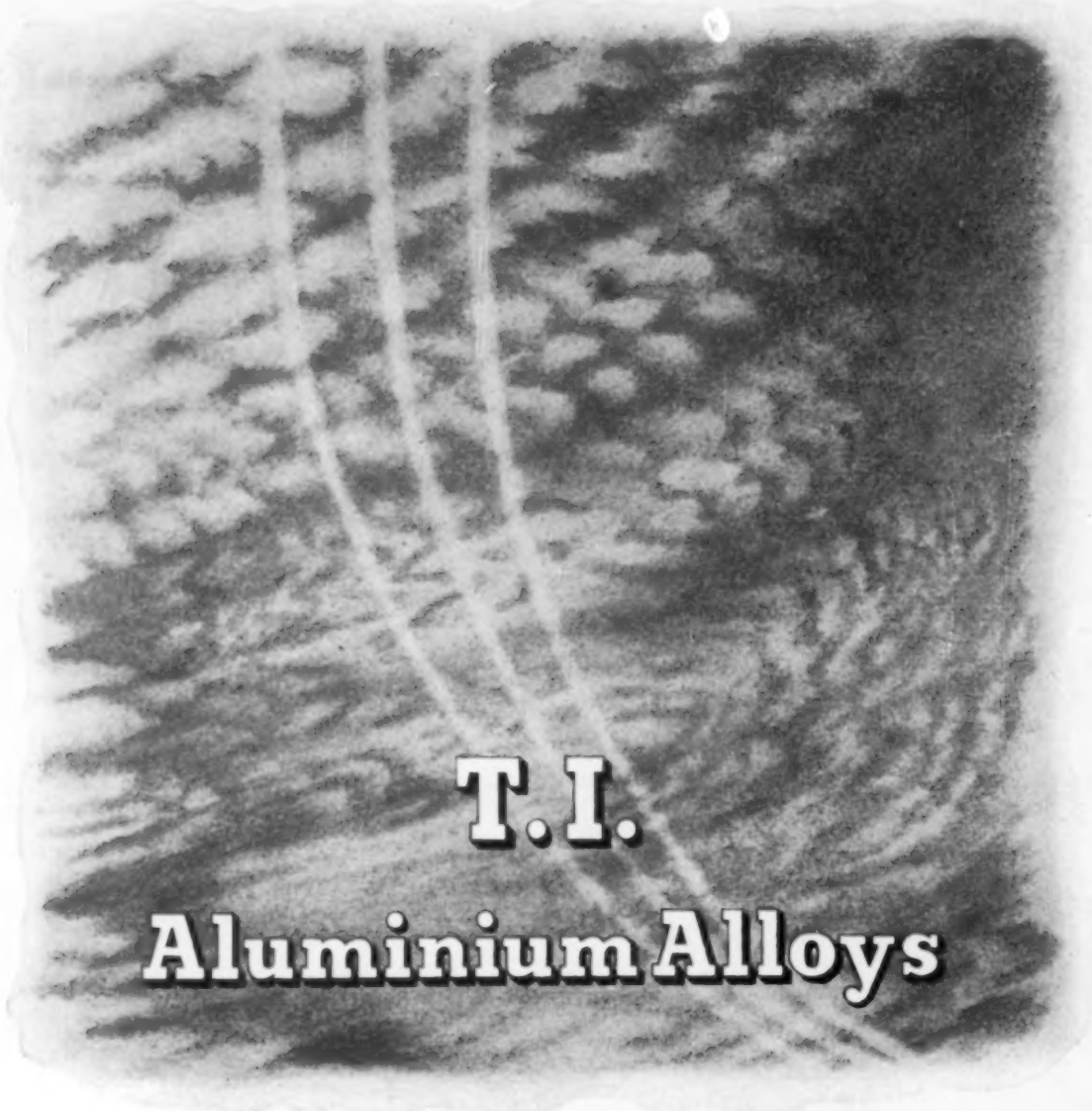

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The Aeronautical Bookshelf

THE REAL WRIGHT BROTHERS

"The Papers of Wilbur and Orville Wright", edited by Marvin W. McFarland, in Two Volumes. McGraw-Hill Book Company Inc., New York. Illustrated. Price $25.00. (Price in England, £10: McGraw Hill Publishing Co., Ltd., 95 Farringdon Street, London, E.C.4.)

EXACTLY 51 years ago today, December 17th, Wilbur and Orville Wright sent a telegram to their father, Bishop Milton Wright of Dayton, Ohio. It stated simply: "SUCCESS FOUR FLIGHTS THURSDAY MORNING ALL AGAINST TWENTY-ONE MILE WIND STARTED FROM LEVEL WITH ENGINE POWER ALONE AVERAGE SPEED THROUGH AIR THIRTY-ONE MILES LONGEST 57 SECONDS INFORM PRESS HOME CHRISTMAS."

Today those four flights are recognized almost everywhere in the world as the first proper controlled, sustained flights ever made by a piloted, powered aeroplane, despite the counter-claims of Mozhaisky, Ader and others. Yet it was not until 1942 that the Wrights' claims were accepted officially and fully by even their own countrymen, because of their long and unhappy dispute with the powerful Smithsonian Institution. Described in Volume Two of these Papers, it was responsible for the fact that the 1903 Wright biplane was for many years displayed in Britain.

This dispute, together with the Wrights' reticence, controversial writings and unprecedented action in taking action for infringement of their patents against Glenn Curtiss in 1909, inevitably made it difficult for their contemporaries to assess their greatness impartially. They behaved at first as scientists working with little thought of reward; yet kept their designs secret, drove a hard bargain and, in 1909, formed a company with a capital of no less than $1 million, turning over to it the disputed patent.

Their friends saw them as modest men. Yet in October 1906 they claimed that there was not "one chance in a hundred that anyone [else would] have a machine of the least practical usefulness within five years" and that the rivalry of the Blériots, Voisins and Santos-Dumonts of this world was not to be feared for a very long time.

Now, in these two volumes, the student of aviation history can decide for himself the true measure of the greatness of these two cycle-makers of Dayton, for there is nothing that reveals a man's true character so much as his private letters.

Not *all* the Wrights' correspondence is contained even in this formidable work of more than 1,270 pages. A notable omission is Wilbur's letter to Arnold Fordyce on January 15th, 1906, in which he wrote: "Like all novices we began with the helicopter [in childhood] but soon saw that it had no future and dropped it. The helicopter does with great labor only what the balloon does without labor, and is no more fitted than the balloon for horizontal flight. If its engine stops it must fall with deathly violence, for it can neither float like the balloon nor glide like the aeroplane. The helicopter is much easier to design than the aeroplane but it is worthless when done."

Nevertheless, the Papers have been edited magnificently by the Aeronautics Division of the Library of Congress, under Marvin McFarland, and make quite clear what aviation experts all over the world now acknowledge—that the real achievement of Wilbur and Orville Wright lay not in flying 120ft in a frail stick-and-string biplane on December 17th, 1903, but in showing that the only true road to progress in aviation was through research.

Theirs was no headlong dash to be the first to fly. They read everything that was worth reading about the efforts of their predecessors, asked questions of those men whom they considered had any worthwhile knowledge—notably Octave Chanute—and then started experimenting with gliders. They decided to make their experiments at Kitty Hawk because the winds appeared to be consistently strong and there was "nothing but soft sand to strike on" in a crash. Even then, wrote Orville on October 18th, 1900: "We have not been on the thing (yet), but merely experiment with the machine alone (as a kite), sometimes loaded with seventy-five pounds of chains. We tried it with tail in front, behind, and every other way."

Those were the words of a scientist, not a would-be birdman; and in these Papers we can trace their steady progress. Their gliding flights in 1900 gave a first indication that Lilienthal's *Tables of Normal and Tangential Pressures* were probably wrong. Then, on October 6th, 1901, Wilbur wrote to Chanute: "We have made the experiment of balancing a curved surface against a plane surface 66 per cent as large, placed normal to the wind, and find that instead of 5° as called for in Lilienthal's table, an angle of 18° was required. The test was made by mounting the surfaces on a bicycle wheel turned over so that its axis was vertical. We found it impossible to get satisfactory results with a natural wind, so we mounted the wheel on a spar projecting in front of a bicycle and made tests in an almost perfect calm . . ."

Wind-tunnel tests followed; then another glider was built, and another. Their papers record successes, disappointments, doubts, doggedness, patience and, finally, confidence. Their 1902 glider was a great success; so they designed and built an engine and fitted it to a new "machine" at Kitty Hawk. From there, on December 14th, 1903, Wilbur wrote to his father: "We gave machine first trial today with only partial success . . . The machinery all worked in entirely satisfactory manner, and seems reliable. There is now no question of final success."

Success was, to them, a logical result of research—as logical as the success of a modern multi-million-dollar programme to develop a new fighter. Yet their total investment in the historic Wright Flyer was probably under a thousand dollars, including its transport to Kitty Hawk.

It is, then, as scientists that we shall remember the Wrights in aviation history and, for that reason, these two volumes of their Papers are doubly valuable, for they contain 236 first-class illustrations covering every aspect of the Wrights' early experiments and later flights throughout the world, as well as some of the other great pioneers and their aircraft. And, finally, there are detailed descriptions and G.A. drawings of almost every type of Wright aeroplane from the first gliders to the Model L scout of 1916, and notes on all the Wright engines. J. W. R. T.

"Blue Wings to Bangkok," by Prince Birabongse of Siam. G. T. Foulis and Co., Ltd., 7 Milford Lane, London, W.C.2. Illustrated. Price 18s 6d.

THE average British private pilot, who must make a little flying go a long way, should derive a good deal of vicarious pleasure from *Blue Wings to Bangkok*, in which racing-motorist "B. Bira" —Prince Birabongse of Siam—describes a 7,300-mile journey in a light aircraft from Lympne to Bangkok, his birthplace. The flight was made, late in 1952, in Gemini G-AJWH; Bira was the pilot and the passengers were his wife Chelita and their dog Tichiboo. On such a journey the occupants of the light aircraft, cruising at 120 m.p.h. at fairly low altitudes and stopping frequently for fuel and rest, see a great deal more than the airline passenger. Bira's book shows that he took advantage of every opportunity for sightseeing—on the ground and in the air. Some readers may envy the author's villa in Cannes and his life of racing, flying, soaring, yachting and "various other sports"; but they will concede, having read this chatty, cheerful narrative, that Bira makes the most of his good fortune.

"Worlds in Space," by Martin Caidin. Sidgwick and Jackson, Ltd., 44 Museum Street, London, W.C.1. Illustrated. Price 17s 6d.

HERE is a book which in terms easily understood by the layman puts the case for a belief in the possibilities of interplanetary travel. The author begins with an account of the developments in rocketry to date—or, at least, those developments which have survived security screening—and continues with an appraisal of the many problems, particularly those of a physiological nature, that will need to be solved before space travel becomes practicable.

After disposing of the worst foreseeable difficulties without recourse to any remedies which unduly tax the imagination, Mr. Caidin continues to outline the probable course of events, including the construction of a space station, leading to the first landing on the Moon and the establishment of a base there. He concludes with a description of the conditions assumed to exist on other members of the solar system.

Sixteen photographs and 48 drawings, all of full-page size, illustrate well the points brought out in the text.

"The Heart of the Storm," by David Beaty. Martin Secker and Warburg, 7 John Street, London, W.C.1. Price 12s 6d.

ARE 22 hours of flying, without rest, too much for an airline pilot? That is the question that Mr. Veitch, manager of the Mid-Atlantic Line of British Empire Airways has to answer to the satisfaction of his own conscience and the demands of an economy-minded chairman. By cutting out a night-stop in the Azores, he could make his line profitable, even with four none-too-reliable Marlborough aircraft; but he finds it difficult to forget that a fifth Marlborough disappeared without trace near Gibraltar.

Capt. Mark Kelston is convinced that a 22-hour stretch is too much; but Mr. Veitch knows that Kelston has a girl friend whom

THE AERONAUTICAL BOOKSHELF . . .

he meets during his night stops in the Azores. Capt. Michael Leeming does not mind the long hop, seeing it as a means of spending more time at home with a wife who is tired of being a grass widow. The night stop is eliminated, despite a series of unfortunate incidents, including a hydraulic-system fire on one of the Marlboroughs. And, almost inevitably, another disappears.

Ex-B.O.A.C. captain David Beaty has written a convincing, technically accurate and almost too-topical novel, exciting enough to appeal to almost every class of reader. One or two of the characters are uncomfortably true-to-life, and it is no book for a nervous air passenger to tuck into his or her overnight bag, or for maiden aunts. But it will probably start a flood of applications for aircrew appointments from the young and amorous.

"Brassey's Annual. The Armed Forces Year-Book, 1954." Edited by Rear-Admiral H. G. Thursfield. William Clowes & Sons, Ltd., London, E.C.4. Price 63s.

THIS year's *Brassey's* is bigger than ever, with a total of more than 480 pages, containing 34 articles by distinguished contributors, a reference section dealing with the 1954 Statement on Defence, Service Estimates and NATO, and an index.

Inevitably, one reads first the chapters dealing with Soviet strategy and military equipment, even though they add little to one's piece of mind. In "Soviet Policy and War", Jules Menken paints a sombre picture of the all-out attack that Russia and her satellites might be ready to launch by the summer of 1957; and Asher Lee's quite sound appraisal of the strength of the Communist Air Forces makes even more tragic the vain hope and expectation expressed in the Editor's chapter that "by the end of the year about half the day-fighter squadrons [of the R.A.F.] will be equipped with Swifts and Hunters."

The chapter on "Aircraft Development" will not satisfy its more knowledgeable readers. The author has collated large quantities of facts and figures; but he has done little to put them in perspective, and there is no excuse for references to the Sherpa as a "near-delta", and the Beverley as a twin-engined aircraft, or for a host of mis-spellings such as Barodeur, Thunder Jet, Dassult, Saab Lance and Nor-Atlas.

"The World's Fighting Planes," by William Green and Gerald Pollinger. Macdonald and Co., Ltd., 16 Maddox Street, London, W.1. Fully Illustrated. Price 12s 6d.

THIS pocket-size reference book includes photographs, silhouettes and data on about 240 of the most important types of military aircraft in service with, or designed for, the world's air forces. It has drawn extensively on material contained in its larger predecessor *The Aircraft of the World;* but is bang up-to-date, with pages on such aircraft as the English Electric P.1, Grumman Tiger and S.F.E.C.M.A.S. Gerfaut. Even more important, it covers fully (and, so far as is possible, accurately) the military aircraft of Yugoslavia, Russia, and the Soviet satellites.

It is a great pity that some of the photographs and drawings have been cut to produce a standard-size illustration, because wheels, wing-tips and fin-tips (and, hence, the "character" of the aeroplanes) have sometimes been lost. A few spotters will also object to the diagonal arrangement of the plan-view silhouettes and to the use of ground views of such aircraft as the Provost and Swift, when good air-to-airs are available. But these are pin-pricks, and *The World's Fighting Planes* is good value.

Some Book Suggestions

BELOW is listed a selection of the numerous books published in association with Iliffe journals and covering a mainly technical but very wide field. Several of those mentioned will suggest themselves as practical Christmas gifts. The books are obtainable at or through booksellers, or by post from Iliffe and Sons, Ltd., Dorset House, Stamford Street, London S.E.1; the postage cost is shown in parenthesis after the price in each case.

"FLIGHT" HANDBOOK (fifth edition), by the staff of *Flight*. Price 15s (8d).

DEVELOPMENT OF THE GUIDED MISSILE (second edition), by Kenneth W. Gatland. Price 15s (8d).

FELLOWSHIP OF THE AIR (Jubilee Book of the Royal Aero Club), by B. J. Hurren. Price 30s (1s 2d).

PHOTOGRAMMETRIC MAPPING FROM AIR PHOTOGRAPHS, by the technical staff of Hunting Aerosurveys, Ltd. Price 7s 6d (3d).

REPRINTS, in brochure form, of illustrated reviews, etc., from recent special numbers of *Flight*, Helicopters of the World, 1s 6d (2d); British and Commonwealth Aircraft, 2s (3d); The First Fifty Years of Powered Flight, 2s (3d).

MECHANICS FOR THE HOME STUDENT, by Eric N. Simons. Price 7s 6d (4d).

PRODUCTION ENGINEERING (Practical Methods of Production Planning and Control), by J. S. Murphy, A.I.I.A. Price 12s 6d (6d).

METALS AND ALLOYS (Specifications of over 4,800 Non-ferrous Alloys; fifth edition). Price 15s (5d).

BASIC MATHEMATICS FOR RADIO STUDENTS (second edition), by F. M. Colebrook, B.Sc., D.I.C., A.C.G.I. Price 2s (2d).

GLASS-REINFORCED PLASTICS, edited by Phillip Morgan, M.A. Price 30s (1s 3d).

"THE AUTOCAR" ROAD TESTS 1954, by *The Autocar* technical staff. Price 8s (4d).

"YACHTING WORLD" ANNUAL 1955. Price 30s (1s 2d).

THE MOTOR CYCLIST'S WORKSHOP (sixth edition), by "Torrens" of *The Motor Cycle*. Price 8s (4d).

PHOTOGRAMS OF THE YEAR 1954 (The Annual Review of the World's Photographic Art). Price 17s 6d (8d).

THE COMPLETE AMATEUR PHOTOGRAPHER (second edition), by Dick Boer; edited by A. L. M. Sowerby, B.A., M.Sc., F.R.P.S. Price 21s (8d).

DESERT VICTORY ON TV

"OUR petrol did not arrive." This cynical five-word report from Rommel to Hitler in 1942 crystallizes the main theme of *Desert Air Force*, Episode 5 of the B.B.C. television film *War in the Air*. This instalment covered the Axis air attacks on Malta, the German assault on Crete and the North African desert battles up to the time of Allied entry into Tripoli.

Of great interest was the sight of a "ringed" Wellington sweeping the Red Sea for magnetic mines and, taken during the Wavell offensive of 1940, shots of the Gladiators and Bombays which represented some of the better machines of the 29 squadrons of obsolescent aircraft that comprised our Middle East Air Force at that time.

After this magnificent Allied advance came the bitter fight for Crete. Six hundred aircraft took part in the German airborne assault. Several lengthy sequences of Ju 52s in action were shown, including a spectacular—and successful—one-wheel landing. Ju 88s (their first appearance in this film) participated in this attack which, although a victory for the Germans, so depleted their paratroop force that they never launched another airborne attack.

The capture of the island gave the Germans virtual control of the Mediterranean; and the air route to Egypt via Takoradi, on the west coast of Africa—surveyed by British Airways before the war—quickly became an important strategical supply line. The film showed the flying-boat base built on the coast to give cover to the ships bringing the crated aircraft from Britain and America; also seen were Hurricanes with long-range tanks in the 3,000-mile "pipe-line."

In December 1941 came the second Allied winter offensive. No mention was made of the effect on the previous offensive of the diversion of troops and aircraft to Greece, although the problem of consolidating our far-flung front line without transport aircraft and troop carriers was stressed. A sequence showed Hurricane IID tank-busters in action—a little prematurely, for these formidable aircraft first saw action during the retreat to El Alamein, when they broke up a dangerous German spearhead well on its way to Cairo.

Once again we were thrust back and the Germans mounted *Operation Hercules*, aimed at the submission of Malta. The last-minute arrival of Spitfire reinforcements and of a tanker—crippled, and escorted by two destroyers—was graphically illustrated. Ju 88s were shown attacking the island and Spitfires (carrying small under-wing bombs!) taking off to intercept them.

The massive build-up of the Allied air contribution to the assault at El Alamein was depicted, until our air forces totalled 1,500 aircraft, of which 1,200 were based in Egypt. The significance of the combined H.Q. of General Montgomery and Air Vice-Marshal Sir Arthur Coningham was not overlooked.

A sequence illustrating an attack by Beaufighters (and two Blenheims?) against German shipping included some excellent shots of the aircraft coming in close and very low in face of heavy defensive fire. Liberators—including some from the U.S.A.A.F.—were shown attacking Tobruk during the big Axis retreat, getting at the ships that managed to evade our sea blockade. Other aircraft seen included gaily decorated Kittyhawks; Baltimores; many Bostons; and, of course, innumerable Hurricanes and Spitfires.

The episode included shots of a most interesting variety of aircraft types, the correct identification of which must have tested the capabilities of even the most expert spotters. And, except for the omission of any reference to the campaigns in Syria, Iraq and Iran, or to the effect of Allied night bombing, the film's intelligent use of maps and diagrams gave viewers a useful insight into the air operations of those fateful days.

M.F.A.

LIQUID FUEL STARTING MEANS VITAL SECONDS SAVED

That the fast-climbing characteristics—so much a feature of the modern interceptor fighter—might be turned to maximum account, the new Plessey Liquid Fuel Starter has been developed. It is flexible in power range; is unaffected by extremes in climatic conditions; is operationally economic and is equally suitable for single, twin or multi-engined craft.

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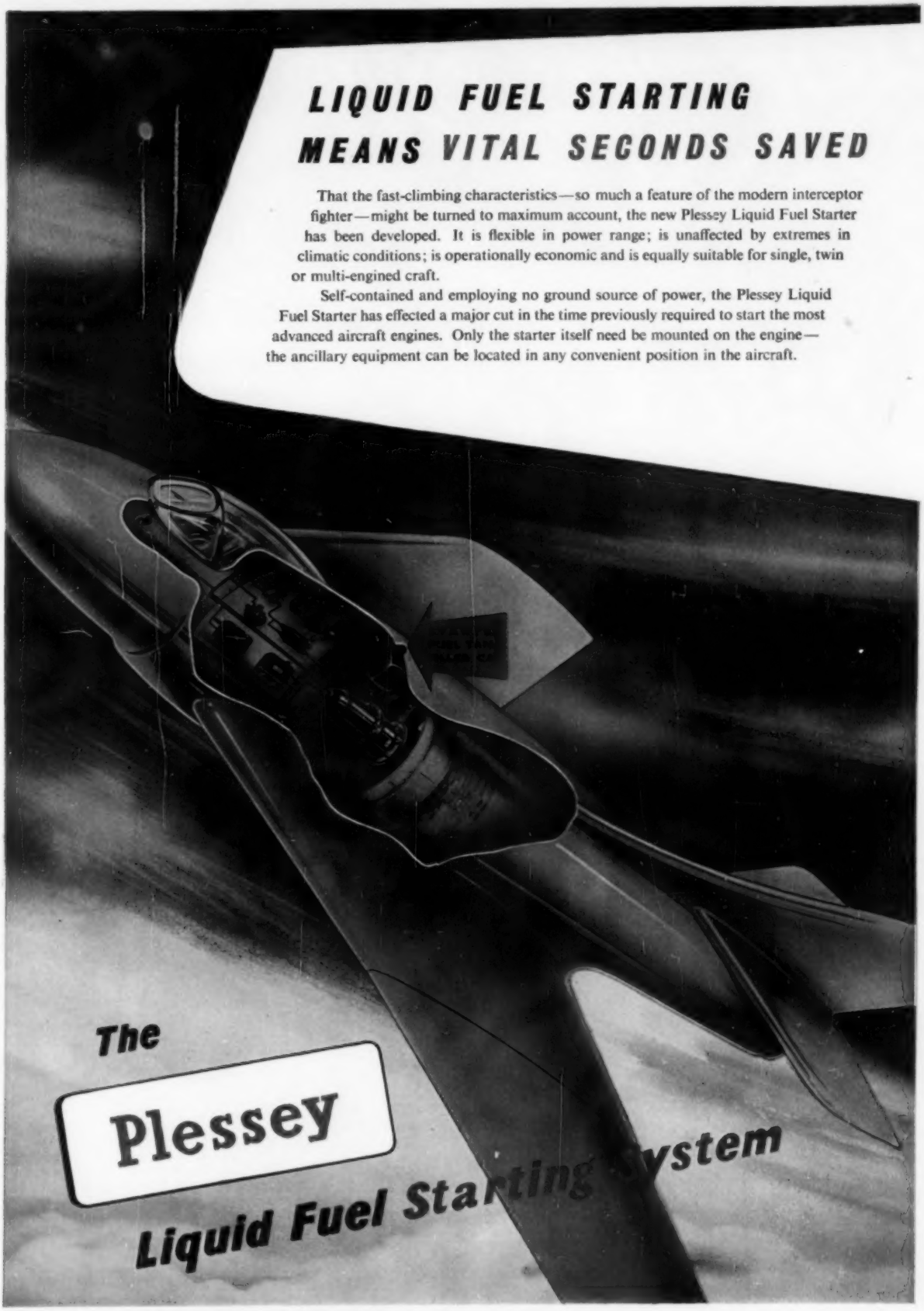

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Canada's first Viscount is shown at Wisley on the day before departure for Montreal. Photographs of the interior appear on the following page.

"Flight" photograph

CIVIL AVIATION

T.C.A. VISCOUNT DELIVERY BEGINS

IN the article "Airline Engineering in Canada" (pages 874-6) reference is made to T.C.A.'s decision to re-style the interior design of their Viscounts. Last week, at Wisley, we were able to examine the first of the airline's new aircraft shortly before its departure for Canada, and to form an opinion of the interior layout developed for T.C.A. by the New York firm of Butler-Zimmerman.

This aircraft, CF-TGI, was fitted out as a 48-seater, though at first T.C.A. Viscounts will carry only 40 passengers. Even in 48-seat form, however, it is remarkably comfortable.

The seats are Aerotherm double chairs weighing only 47 lb, laid out in two rows of ten or twelve, according to the density required. Seat pitching is reduced from 39 to 34 inches in the 48-seat version, but the chair design is such that ample leg-room remains.

With the exception of the rear row, all seats are fully reclining, and though 12 seat-rows cannot be precisely aligned with ten pairs of windows, the effect on passengers' visibility is surprisingly small. The reading-light and ventilation-control panel by each pair of seats incorporates a new feature: a plastic call-button which lights up when pushed and sounds a melodious gong at the stewardess's station. Galley and cloakroom are at the tail of the aircraft, and the two toilets are placed on either side of the gangway immediately forward of the passenger cabin.

Surprisingly, perhaps, the colour scheme is very conventional; it appears that the designer was in fact aiming at a "neutral" effect. Fawn and beige are predominant, being employed for the seats, ceiling and cabin walls. The floor covering is a rubber-backed plastic material, dark brown in colour and extremely hard-wearing, but of dull appearance. The only real touches of colour are the upholstered forward bulkhead and window frames, in pastel green, and the transverse-striped curtains, woven by "Karen Bulow of Montreal . . . in keeping with the décor."

Though all of the Viscount's 20 cabin windows are designed for use as emergency exits, the T.C.A. versions have only three exits on each side—the fourth, sixth and tenth pairs of windows. This arrangement is regarded as adequate for any foreseeable emergency, and—since extra thicknesses of Perspex can be used on all the permanently sealed windows—results in reduced cabin-noise.

Brochures distributed by Capital Airlines indicated that the same type of seat and interior design will be embodied in Capital's Viscounts. Photographs of the T.C.A. 48-seat interior appear overleaf.

The delivery flight of CF-TGI began on December 8th with its departure from Wisley for Prestwick. It was captained by Vickers' chief test pilot, Mr. G. R. Bryce, accompanied by the flight superintendent of T.C.A., Captain George Lothian. Other members of the crew were Mr. D. L. Jones and Mr. D. Wood (navigators) and Mr. E. Walker and Mr. E. Day (engineers). Aboard the aircraft was the managing director of Vickers-Armstrongs, Ltd. (Aircraft Division), Mr. George Edwards, the head of the team which designed the Viscount and the architect of its success in the export market.

The aircraft was delayed overnight at Prestwick by radio trouble and flew on to Keflavik next day, making the 850-mile journey in 2 hr 28 min; here, strong gales caused a further delay. The remaining stages of the journey were Keflavik-Bluie West (750 miles), Bluie West-Goose Bay (780 miles) and Goose Bay-Dorval, Montreal (810 miles). It arrived at Dorval on Sunday and was due to fly on to Winnipeg the following day.

The second of T.C.A.'s Viscounts is now practically complete at Weybridge, where the third machine is also under construction for the Canadian airline; the remainder of the series are being built at Hurn.

Viscounts will be introduced on Canadian domestic routes next February and are due to take over the services from Toronto and Montreal to New York the following month.

T.C.A. will begin the training of 40 two-man crews for the Viscount on January 3rd. The training programme, involving 750 to 800 flying hours, will extend over a period of five months.

The Series 724 Viscount for T.C.A. is the first to be powered by the up-rated Dart 506. This engine increases climbing and cruising power by 80 to 90 s.h.p. and reduces specific fuel consumption by 9 per cent. The additional cruising power raises the speed of the Viscount to an average of 320 m.p.h.

Among other features which distinguish the 724 from B.E.A.'s Viscount 701s are: individual fuel feed to each engine; Dunlop Maxaret non-skid brakes; deletion of the autopilot; flush intake for cabin air conditioning; cabin air recirculating system; and automatic AiResearch control for cabin pressurization.

Canadian Viscounts will burn JP-4, a wide-cut gasoline, instead of kerosine. One reason for this is the fact that existing Canadian refineries can readily produce the required quantities of JP-4, whereas kerosine of the quality necessary for low temperature operation would have to be specially refined from imported crude oils. As a result, Canadian Viscount fuel will cost up to 4 cents less per gallon than locally refined kerosine, reducing T.C.A.'s fuel bill by nearly £70,000 a year.

B.I.A.T.A. ANNUAL REPORT AND DINNER

WE have the impression that, individually, most of the independent operators have been enjoying increased business over the past year. But their collective annual report, published last week by the British Independent Air Transport Association, emphasizes the bleaker aspects of their existence. Members may feel that references to increased traffic would divert attention from their unanimous belief that the Corporations retain an outsize slice of the British air-transport cake.

The report emphasizes, in large type, that five-sixths of independent traffic is non-scheduled and therefore does not provide a sound basis for financial investment. It points out also that independents provide "only four per cent of the total United Kingdom air-transport effort on scheduled services." During the year 1953-54, it adds, the average revenue earned per load ton-mile by B.I.A.T.A. companies was between 25d and 30d, compared with 62.8d for B.O.A.C. and 63.8d for B.E.A. Finally, the B.I.A.T.A. report contrasts the total airmail revenue of the independents (£9,500) with that earned by B.O.A.C. (£9m) and B.E.A. (£1.1m).

On international routes, the report states, only one new independent service of normal type was approved, and of the seven Colonial Coach services approved, five were for periods of three years or less. The opportunities foreseen in this type of service appeared to be very limited indeed. Trooping had continued to be the most important of independents' non-scheduled activities, but all contracts were subject to only three months' notice.

Following the annual meeting of B.I.A.T.A. on December 8th, the customary dinner was held. The new Minister of Civil Aviation, Mr. J. A. Boyd-Carpenter, was guest of honour, and present also was his predecessor, Mr. A. T. Lennox-Boyd. The Minister replied to the toast, "Her Majesty's Government," proposed by A. Cdre. G. J. Powell, chairman of B.I.A.T.A., who has now handed on this office, which he has held for the past two years, to the managing director of Hunting-Clan Air Transport, Mr. M. H. Curtis. The response to Mr. Curtis's toast, "The Guests," was made by a leading French independent operator, M. J. Richard-Deshais, president of C.G.T.A.-Air Algérie.

CIVIL AVIATION . . .

"Flagship Missouri," one of American Airlines' now-complete fleet of 25 Douglas DC-7s. These aircraft operate the company's non-stop trans-continental services, which—as reported below—have just completed a first year of operation.

COAST-TO-COAST ANNIVERSARY

RESULTS achieved by America's first coast-to-coast non-stop air service were summarized last week by American Airlines, who inaugurated the service on November 29th, 1953. In the first year, the company's DC-7s made a total of 1,458 trans-continental flights, carrying 66,500 passengers. These 60-seat aircraft make three round trips daily between Los Angeles and New York ("Nonstop Mercury") and a fourth ("Statesman") between Los Angeles and Washington.

Introduction of non-stop flights made it possible for passengers to have lunch in New York and dinner in Los Angeles, or for the eastbound traveller to breakfast in Los Angeles and dine in New York. As a result, American Airlines have experienced a 73 per cent increase in traffic between these cities. This extra traffic was spread over all A.A.'s coast-to-coast routes, including stopping services.

The airline now has its full fleet of 25 DC-7s, the 25th having been delivered in August. They are scheduled to fly from Los Angeles to New York in 7 hr 15 min, and the westbound services, operated against the prevailing winds, are scheduled to take 8 hr 35 min.

The officially observed record for the 2,468-mile Los Angeles to New York route, set up on March 30th, is 6 hr 10 min—an average speed of 400 m.p.h. On November 28th an unofficial record of 5 hr 26 min (425 m.p.h.) was established on the 2,305-mile Los Angeles to Washington route. The fastest westbound time on the New York run, recorded on February 7th, is 7 hr 7 min (349 m.p.h.). All three flights were operating to normal schedules with passengers, mail and cargo aboard.

Non-stop westbound flights were suspended during August, when American Airlines pilots struck in protest against the waiving of the so-called eight-hour rule—a Civil Air Regulation prohibiting domestic non-stop flights of more than eight hours' duration. After 25 days the pilots returned to work, and an independent referee was appointed to determine whether waiving of the eight-hour rule could be continued indefinitely to permit the operation of this particular service. His findings, it is reported, are in favour of the airline.

The westbound non-stop service appears to be regarded by the C.A.B. as an isolated instance. There is no other domestic route of such a length where non-stop service is considered desirable. Furthermore, the DC-7 is, to quote American Airlines, "generally regarded to be the last of the reciprocating-engine airliners," and its successor—turbojet or turboprop (A.A. favour the latter)—is certain to be faster. Thus, the question of operating a U.S. domestic stage of more than eight hours' flying time is not likely ever to arise again.

ADVANTAGES OF HIGH-WING AIRLINERS

THE second Mitchell Memorial Lecture was delivered before the Southampton Branch of the Royal Aeronautical Society on November 24th by Mr. Peter Masefield, chief executive of B.E.A. Mr. Masefield chose for his subject *Some Problems and Prospects in Civil Air Transport*. His remarks on transport aircraft included a lengthy discussion of wing position as a major factor in design.

A widely held opinion in favour of the high-wing arrangement, said Mr. Masefield, had evolved from the outstanding success of the Elizabethan. Development of new and more powerful engines turning large-diameter airscrews also favoured the high wing, because the need to give adequate blade clearance would otherwise make the passenger door-sill exceptionally high off the ground. He went on to enumerate the following advantages of a high-wing layout:—

(1) Low loading position of fuselage—speeding turn-rounds and saving expensive steps.
(2) Good view for passengers from all seats.
(3) No dazzling reflections into the cabin from the wing.
(4) A "sunshade" above the cabin.
(5) Ease of maintenance because of accessibility of control runs in the roof.
(6) Less engineering trestles required for overhaul.
(7) Shorter nose-wheel.

Aspects of the new Viscount interior developed by a New York design firm for Trans-Canada Air Lines. It differs in several respects from B.E.A.'s Series 47-seat 701s; seats, of a new American type, are in rows of four, instead of five; and the T.C.A. Series 724 has two toilets forward instead of one aft. Initially, the Canadian Viscounts will enter service as 40-seaters, but by reducing seat-pitch 48 seats can be fitted—as in the picture below. "Flight" photographs

The virtues of the high wing (see item below) are exemplified in B.E.A.'s Elizabethan-class D.H. Airspeed Ambassadors. Shown here is Elizabethan G-AMAG "Sir Thomas Gresham," one of the fleet of 20, about to touch down at London Airport.
"Flight" photograph

(8) Lower overall height for hangar doors.
(9) Less damage in a belly landing, because the engines and wing are clear of the ground.

The disadvantages included poor ditching characteristics, slightly heavier structure weight and problems of main undercarriage stowage.

Analysis of turn-round or transit times at airports would show how the high wing could improve economy of operation. Service vehicles could drive all round the aircraft without going up against the wing; long steps and fork lifts were not needed, and access to doors and holds was simpler and quicker. Other things being equal, the high wing could reduce a transit time from between five and ten minutes.

Summing up, Mr. Masefield said: "We in B.E.A. believe firmly in the high wing—a view based on practical experience of both types."

These remarks help to confirm and to clarify reports that the proposed successor to the Viscount will, at B.E.A.'s request, feature a high-wing layout.

At another recent lecture (before the Liverpool Economy and Statistical Society on December 8th) Mr. Masefield said that plans for such an airliner—"as far ahead of our Viscount aircraft as Viscounts are today ahead of anything else"—were already on the drawing board. The aircraft [which is to be powered by Rolls-Royce R.B.109s] would come into service about 1960.

IMPROVING WOOLSINGTON

THE City Corporation of Newcastle is reported to be seeking a 100 per cent M.T.C.A. grant to cover the cost of improving Woolsington Airport. The sum involved is said to be nearly £300,000, which would be spent on additional hangar accommodation, new terminal buildings, and runway extension. Hunting-Clan Air Transport, whose northern network of domestic and international services is based on Woolsington, announced recently that, subject to the necessary development of the airport, they hoped to operate Viscounts from Woolsington next summer.

AIRPORT ACTIVITY DURING SEPTEMBER

A TWELVE per cent increase in transport aircraft movements at U.K. aerodromes (compared with the same month last year) was recorded for September, the total being 26,600. A total of 518,400 passengers were handled, an increase of 17 per cent over September 1953. Increases in cross-Channel vehicle ferry traffic caused the freight total to rise even more steeply, the total on and off-loaded amounting to 11,200 tons, an increase of 35 per cent.

London and Northolt Airports together handled 268,000 passengers, 14 per cent more than in the same month last year. Increasing traffic at L.A.P. was reflected in figures for aircraft movements and passengers handled of 7,870 and 195,500 respectively.

The passenger traffic at provincial airports also continued to increase. Totals of passengers handled, with percentage increases over September 1953 in parentheses, are: Jersey, 53,100 (22), Manchester (Ringway) 30,600 (22), Glasgow (Renfrew) 28,300 (28), Liverpool (Speke) 13,100 (25) and Birmingham (Elmdon) 12,300 (42).

EUROPEAN FARES INCREASES

AS decided at this autumn's I.A.T.A. traffic conference, fares on many European international routes are to be increased by five to ten per cent. Some details of the new fares structure, effective from April 1st next, have now been published by B.E.A. The cost of a London-Paris return fare, for example, will go up by 16s to £13 16s, and the London-Rome return fare, now £47 14s, will increase by £2 9s. There will also be increases on the routes from London to Lisbon, Madrid, Naples, Palma, Vienna, Geneva, Dusseldorf, Berlin and Zurich.

No increases will be made in existing fares from London to Athens, Beirut, Cairo, Copenhagen, Gibraltar, Istanbul, Malta, Cyprus, Oslo, Stockholm and Tripoli. Bookings made on any route before March 2nd will be at present fares if the journey is to begin before May 2nd.

BREVITIES

THE B.E.A. helicopter service between London Airport and Southampton, which was inaugurated on June 15th last, had carried 770 passengers by October 30th, and the number of scheduled flights operated by the Bristol 171s had reached 302. B.E.A. report that many of the passengers booked on the service simply to experience helicopter travel, and that the overall reaction was extremely favourable.

* * *

An unusual long-distance charter performed by an Eagle Aviation Dakota recently was the lifting of two ship components from Hamburg to Brisbane. The parts, described by Eagle as among their largest and most awkward loads, were tie-bolts, 26ft long but only 5in in diameter and each weighing one ton.

* * *

Next summer should see a considerable growth of traffic to Bembridge, Isle of Wight. Independent operators have announced plans for introducing services linking Bembridge with Newcastle, Leeds and Bournemouth (B.K.S. Air Transport), Liverpool and London (Starways), Manchester (Airviews), and Southend and Shoreham. The airport has a grass runway of 4,250ft which is suitable for use by Dakotas.

* * *

Avianca, the national airline of Colombia, celebrated its 35th anniversary on December 5th. It is thus one of the oldest airlines in the world and certainly the longest-established of all South American operators. The company's services now operate at a rate of 70 flights daily and include a transatlantic route to Frankfurt, Paris, Madrid and Lisbon. The company is among the world's foremost air freight carriers, lifting 210 tons daily.

Two new unofficial Super Constellation records were set up recently by Iberia and T.C.A. One of the Spanish airline's new aircraft flew non-stop from New York to Madrid (3,581 miles) in 9 hr 27 min, and a T.C.A. Super Connie covered the 2,986 miles from Montreal to Prestwick in 8 hr 8 min.

* * *

Also announced are three new unofficial Viscount records. On December 6th a B.E.A. Viscount flew from London to Barcelona (713 miles) in 2 hr 1 min and on the same day another of B.E.A.'s Viscounts flew from London to Zurich (489 miles) in 1 hr 23 min, achieving an average speed of 353 m.p.h., the best yet achieved by the type on any route. The previous day an Air France Viscount had covered the 227-mile London-Paris route in 42 minutes.

* * *

Damage estimated at nearly £1m was caused by a hangar fire at Calgary Municipal Airport on December 6th. Among the 25 aircraft destroyed were a Dakota, a Beechcraft D-18S, a Dove, a Beaver and an Anson. Two days later another hangar fire occurred at St. John's Airport, Quebec, and 12 more aircraft were destroyed.

* * *

Returning to London Airport on December 8th after a tour of the "big three" transport manufacturers in the United States, B.O.A.C.'s deputy chairman, Mr. Whitney Straight, said that the Corporation had not yet reached a decision on the question of buying DC-7s. Regarding the recent attacks on B.O.A.C. for contemplating purchase of these aircraft, he is quoted as saying that American airlines had bought Viscounts from Britain, and we could not expect to have one-way trade.

LONG-RANGE BATTLE CONTINUES

Britannia 300 L.R. versus DC-7C as a Non-stop Atlantic Transport

ON November 5th, under the title "Long-Range Battle," *Flight* surveyed the prospects of two big airscrew-driven transports now being prepared for airline service in the future. Since then this subject has been debated and discussed at great length, and the extent of printed and spoken words concerning the relative merits of the Bristol Britannia and the developed Douglas DC-7s has been sufficient to fill several volumes.

Without attempting to suggest a clear-cut solution to the problems now faced by operators and manufacturers, we summarize here some of the points most recently aired.

Unqualified comparisons between two types of airliner are rarely valid. The only occasion when a comparison is fully justified is when an airline has to make a decision to buy one or other type. Even then, the choice is influenced by factors other than the virtues of the aircraft as pieces of engineering designed for a specific purpose. An operator preferring type A might choose type B for reason of delivery date, development background, reluctance to break with the supplier of his previous equipment—or a combination of all three.

Recent "popular" evaluations of the Britannia vis-a-vis the DC-7 have ignored many of these "qualifying" considerations. In the first place, there are four distinct versions of the Britannia and two potentially competitive versions of the DC-7. The forecast performance of each version must be related to its estimated date of availability or introduction to service, viz:—

Type	*Introduction or delivery*
Britannia 100	January 1956
Britannia 300	June 1956
Britannia 300 L.R.	January 1957
DC-7C (piston engines)	1957
Britannia 300 L.R. with B.E.25	1958-59
DC-7D (turboprop—R.B.109?)	1958-59

The developed Britannia and the turboprop Douglas thus appear as contemporaries. On paper, both are promising, but it has been pointed out that, at present, the American aircraft is only at the project stage. The wing will need complete re-design, and considerable re-engineering of the rest of the airframe might be required. The Britannia airframe already exists and, being of later design and much greater capacity, is much more amenable to the installation of new turboprops with higher cruising output. So far as engine development is concerned, of the types which have been associated with the aircraft neither the B.E.25 nor the R.B.109 has yet run.

Comparison between the Proteus-engined Britannias and the piston-engined DC-7C is of greater immediate interest, because their performance can be more firmly predicted. Furthermore, they are already contemporaries in the civil market, though B.O.A.C. will have taken delivery of most of their 25 Britannia 100s and 300s by the time DC-7Cs become generally available. Bristols quote 80,000 hours as a conservative estimate of the Britannia flying time which the Corporation will by then have accumulated. In these circumstances, the Britannia would certainly have far more appeal than it possesses today.

Route analysis is undoubtedly the best method of examining the performance of an airliner, particularly when the route chosen is an important international one flown by several airlines in competition. The following figures summarize the commercial performances of the long-range Britannia 300 (with Proteus 755) and the DC-7C respectively. Below are the latest figures to become available:

London—New York (85 per cent regularity)

	Britannia 300 LR	Douglas DC-7C
Payload	15,200 lb	14,000 lb
Passengers	63	58
Cruising Speed	346 m.p.h. TAS	290 m.p.h. TAS
Time	13.7 hr	15.6 hr
Altitude	30,000 ft	15,000 ft
Headwind	86 m.p.h.	58 m.p.h.

New York—London (85 per cent regularity)

	Britannia 300 LR	Douglas DC-7C
Payload	24,200 lb	19,200 lb
Passengers	100	88
Cruising Speed	369 m.p.h. TAS	322 m.p.h. TAS
Time	9 hr	10.4 hr
Altitude	25,000 ft	23,500 ft
Tailwind	25 m.p.h.	23 m.p.h.

As a result of its greater capacity, it is thought that the Britannia might well enjoy an advantage of five to ten per cent in operating cost. Another important feature is its greater stage-length flexibility; the DC-7C, formidable competitor though it may be, is designed almost solely for long-range work.

Preliminary details of another new contender for North Atlantic traffic in the late 1950s, namely, the Lockheed 1449 Super Constellation, are given on page 857. Both Pan American with their improved Boeing Stratocruisers and B.O.A.C. with standard Stratocruisers expect to use these aircraft over the North Atlantic for at least four more years.

AIRLINE PILOTS' PARTY

A cocktail party was held by the Central Board of the British Air Line Pilots Association at the Royal Aero Club Aviation Centre at Londonderry House, Park Lane, on Thursday, December 9th. Shown in the photographs, taken on this occasion, are: upper left, Mr. Dennis Follows (secretary, B.A.L.P.A.), Sir Robert Perkins (vice-president, B.A.L.P.A.) and Mr. Lane Burslem; upper right, Captains E. A. Jackson (Aer Lingus), G. W. Henderson (U.A.L.), W. D. McMinn (T.W.A.), C. C. Jackson (technical secretary, I.F.A.L.P.A.) and R. F. Baar (T.W.A.); lower left, Captains P. Wigley (Airwork), W. G. Cole (Skyways), G. W. Harding and D. T. Witham (B.O.A.C.); lower right, Capt. C. G. Klimcke (B.E.A.), Capt. D. Martin (technical secretary, B.A.L.P.A.) and Mr. D. Jameson (A.R.B.).

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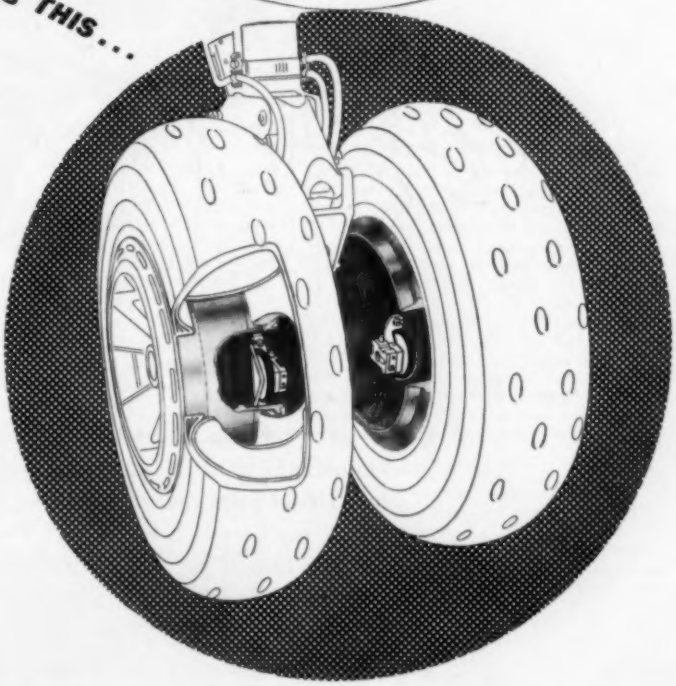

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Bees and Bats

EVERY NOW AND AGAIN, said the Managing Director, someone gets a bee in his bonnet. He wants to put a nut where no nut was ever put before, or drill a hole round umpteen corners in a place only a bow-legged dwarf could reach. What, my friends is the result? Production lines go haywire and foremen go berserk. Should we then send such a person to Coventry? Not so. We should send him instead to the Desoutter Works, where members of my loyal staff are lined up waiting to give him what he deserves—some entirely new small power tool which puts his idea into practice at positively no trouble to anyone.

This service, which we are happy to provide for those with bees in the bonnet, does NOT apply to those with bats in the belfry.

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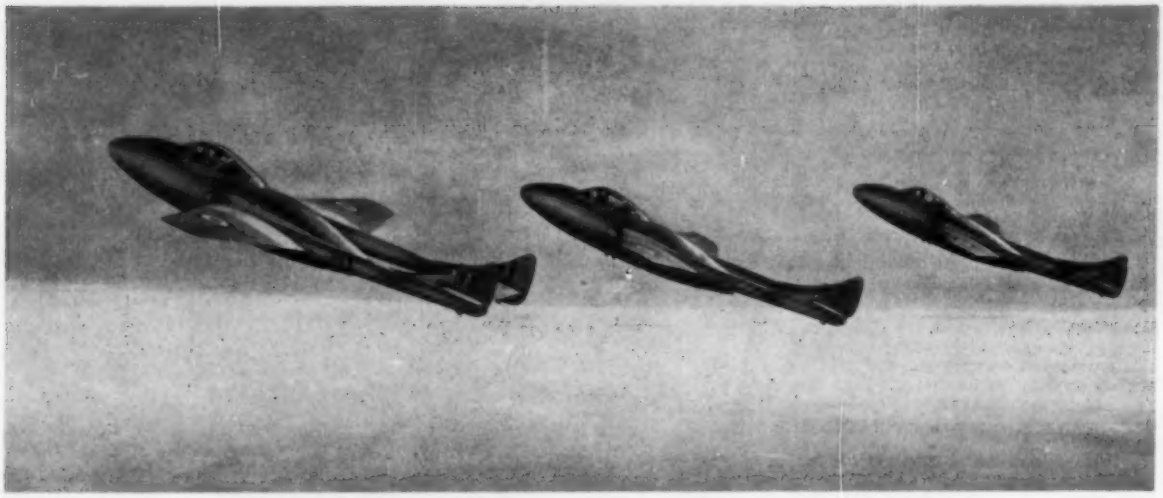


Three instructors of No. 5 Flying Training School at Oakington present an unusual picture while climbing their Vampire Trainers in echelon starboard. The de Havilland Vampire Trainer is in service with the air forces of 14 nations.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

Sub-Arctic Airborne Exercise

ONE of the most ambitious military exercises ever held in the Sub-Arctic —the Canadian Army's Bulldog II—was recently launched by the seizure of a weather and radar station 400 miles north of Fort Churchill on the north-west shore of Hudson Bay. In this attack, French Canadian troops simulated an airborne enemy landing from across the North Pole, with the stoppage of the station's scheduled hourly signals as the first warning.

The attackers' bivouacs in the area were photographed from the air and preparations made to parachute units of the Royal Canadian Regiment for a counter-attack. The invaders, however, made good use of arctic darkness to hide their movements and carried out several successful raids against defending rangers and scouts. The airborne counter-attack had to be postponed seven times in four days owing to constant changes of wind and visibility, and the landing of troop-carrying aircraft on a nearby frozen lake was found to be impossible because the ice was only nine inches thick.

The opportunity was taken during the exercise for testing a variety of Arctic equipment. Clothing under test by the Ministry of Supply in London had been sent out to Canada for the exercise and was worn by a Canadian research worker who made a parachute descent with the defending troops. Fast snow vehicles and special helmets were also tried, but most of the new equipment concerned is still secret.

Air Ministry Appointment

HAVING completed a course at the Imperial Defence College, A. Cdre. H. J. Kirkpatrick, C.B.E., D.F.C., has been appointed Director of Operational Requirements (A) at the Air Ministry.

A. Cdre. Kirkpatrick's war service included operational flying with No. 9 and No. 218 Squadrons; the latter unit he commanded for eight months. His later war appointments were as station commander at Wyton and S.A.S.O. at No. 3 Group.

Trucial Coast Demonstration

RECENTLY the Sultans of six States on the Trucial Coast embarked in the cruiser H.M.S. *Newfoundland* for a demonstration exercise in the Persian Gulf. The cruiser was accompanied by the frigate *Loch Insh* and by aircraft of No. 73 Squadron, R.A.F., based at Habbaniya. Vice-Admiral C. F. W. Norris, C.B., D.S.O., wore his flag in *Newfoundland*.

The exercise included the firing of six-inch, four-inch and close-range armament and *Loch Insh* made a demonstration attack with underwater weapons. The Venoms of No. 73 Squadron carried out a rocket attack against a towed target.

The Gloucester Cup

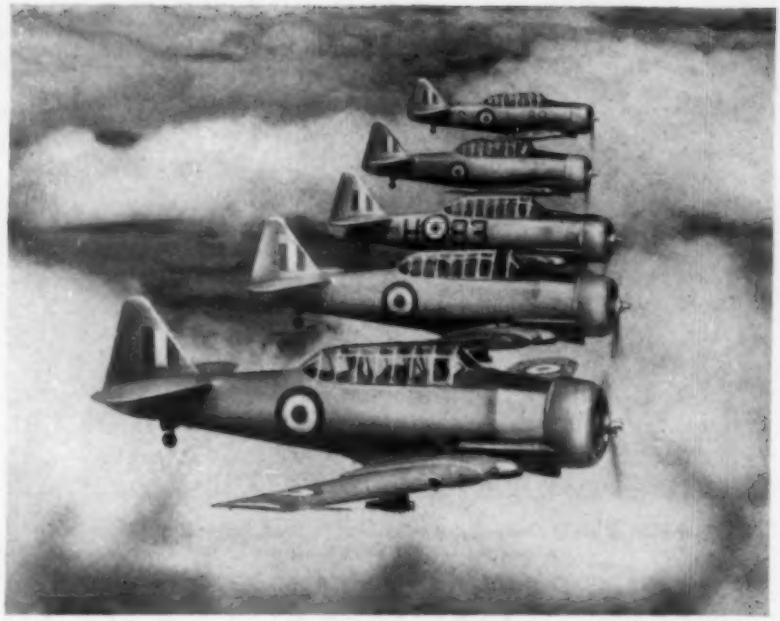
FOR the current year the Duke of Gloucester Cup has been awarded to No. 38 Squadron, R.A.A.F. This was the unit which operated the air-transport facilities for Her Majesty The Queen and H.R.H. The Duke of Edinburgh during their tour of Australia.

Two R.A.F. Awards

FOR bravery during outbreaks of fire F/O. I. H. W. Lamey has been awarded the M.B.E. and S. A/C. C. Smith the B.E.M.

In a power station at No. 16 M.U., a

Taken on the day that the squadron commissioned at R.N.A.S. Brawdy—November 8th —this picture shows officers of No. 800 Squadron, equipped with Hawker Sea Hawks. Left to right, they are: Lt. (E) Campbell, Sub-Lt. K. E. N. Gregson, Sub-Lt. (L) Berry (electrical officer), Lt. I. G. Shirras (staff officer), Lt. L. W. Wilcox (operations officer), Sub-Lt. Blackburn, Lt.-Cdr. (E) C. R. Heaton (air engineering officer), Lt. J. Bower, Lt.-Cdr. R. D. Lygo (commanding officer), Lt. P. J. Barker, Lt. Leary (senior pilot), Lt. N. J. P. Mills.



Five Harvards, each carrying eight fragmentation bombs, maintain close formation on the way to a terrorist hide in Kenya. These aircraft belong to No. 1340 Flight, based at Nairobi, whose work was described in "Flight" of November 12th.

SERVICE AVIATION...

serious explosion was followed by fire. Although unfamiliar with the building, F/O. Lamey forced his way through smoke and burning fuel oil to rescue an unconscious engineman.

S. A/C. Smith received his award for driving away from a line of Meteors a tanker which had caught fire during defuelling. He had never driven a vehicle of this type before and the driver's cab was already on fire; yet he drove it some 150 yards on to the airfield.

West Lancashire Dines

EARLY this month the three West Lancashire R.Aux.A.F. units, No. 611 Squadron (S/L. S. J. Kirtley), No. 2611 Squadron (S/L. A. R. Poole, D.S.O., D.F.C.) and No. 3611 Squadron (W/C. J. P. Hitchen), held their annual dinner at Fazakerley. Among the guests were A.V-M. W. J. Chrisham, C.B., C.B.E., G/C. J. M. Birkin, D.S.O., O.B.E., D.F.C., A.F.C., and Brigadier D. I. Crawford, C.B., D.S.O., T.D., D.L., A.D.C.

Home for Christmas

THE aircraft carriers *Triumph* and *Warrior* are both due to return to Britain this week in time for Christmas leave.

H.M.S. *Triumph*, which is the cadet training carrier, commanded by Capt. R. H. Wright, D.S.C. and Bar, R.N., has been in the Mediterranean. *Warrior* (Capt. P. J. Milner-Barry, R.N.) is back from the Far East, where she served in Korean Waters and assisted in the transfer of refugees from North to South Vietnam. On the journey home, calls were made at several South African ports.

Chevrons Club "At Home"

LAST evening, December 16th, H.R.H. Princess Alice of Athlone and the Earl of Athlone were due to attend an "At Home" at the Chevrons Club, Dorset Square.

The Chevrons Club was founded in 1918 for non-commissioned officers of the three Services and the Commonwealth forces. It is equipped with a ballroom, bars, library, reading-room, lounges and other amenities, including sleeping accommodation for one hundred.

The chairman of the club is Mr. Edward Terrell, O.B.E., Recorder of Newbury, who served as a captain in the R.N.V.R. in the 1939-45 war.

R.A.F. Appointments

AMONG recent appointments announced by the Air Ministry are the following. In command, G/C. R. Harston to No. 4 M.U. and G/C. W. Mac I. King to No. 107 M.U., M.E.A.F.

For administrative staff duties, G/C. E. A. Biddle to Technical Training Command; G/C. E. Earnshaw to H.Q. 2nd T.A.F.; G/C. C. E. Slee, M.V.O., A.F.C., to Maintenance Command; W/C. E. M. Webb to H.Q., F.E.A.F.; Act. W/C. K. W. C. Bindloss to Technical Training Command; and Act. W/C. J. Eames, D.F.C., to Coastal Command.

Other appointments include those of G/C. G. A. L. Manton to A.A.F.C.E. for staff duties; W/C. C. E. Drapper to Benson for Flying Wing duties; W/C. G. S. Fry, D.F.C., to the Department of the Chief of the Air Staff; and Act. W/C. W. J. P. Cunningham to the Department of the Air Member for Supply and Organization.

The R.A.F. and the Swift

ACCORDING to a recent Air Ministry statement the Vickers-Supermarine Swift "is still being evaluated." Swifts were first cleared for service with the R.A.F. early this year, and one squadron, No. 56, at Waterbeach, received a number of the Mk 1 and Mk 2 versions. These aircraft were twice grounded and no further examples have yet been issued to squadrons.

The Swift first flew in August, 1951, and the first production model took the air in August, 1952.

Reservists for R.O.C

THE Under-Secretary of State for Air, Mr. George Ward, has stated in a Parliamentary written reply that, in order to make up deficiencies in the Royal Observer Corps, it is proposed to invite class "H" reservists surplus to R.A.F. mobilization requirements to volunteer for service with the Corps.

The first batch of 3,000 invitations will be sent out early next year. Reservists who accept the invitation, and who carry out their duties satisfactorily, will not be called up for R.A.F. training in addition.

R.C.Aux.A.F. Jets

DELIVERY of Canadair-built T-33 Silver Stars to the Canadian auxiliary fighter squadrons is now under way. Four of the squadrons at present have Vampire fighters, and the remainder Mustangs. The T-33s are preparing the way for CF-100s, with which all these squadrons will soon be equipped.

R.A.A.F. Wants Doctors

OWING to an acute shortage in Australia, the R.A.A.F. is to invite applications from doctors in Britain to enlist in the Service. At least ten are required immediately and they would be granted first class passages to Australia for themselves and their families. The period of enlistment is a minimum of four years.

By employing H.M.S. "Triumph" as the cadet training ship the Royal Navy is now able to give the cadets air experience in Sea Balliols operating from the flight deck.

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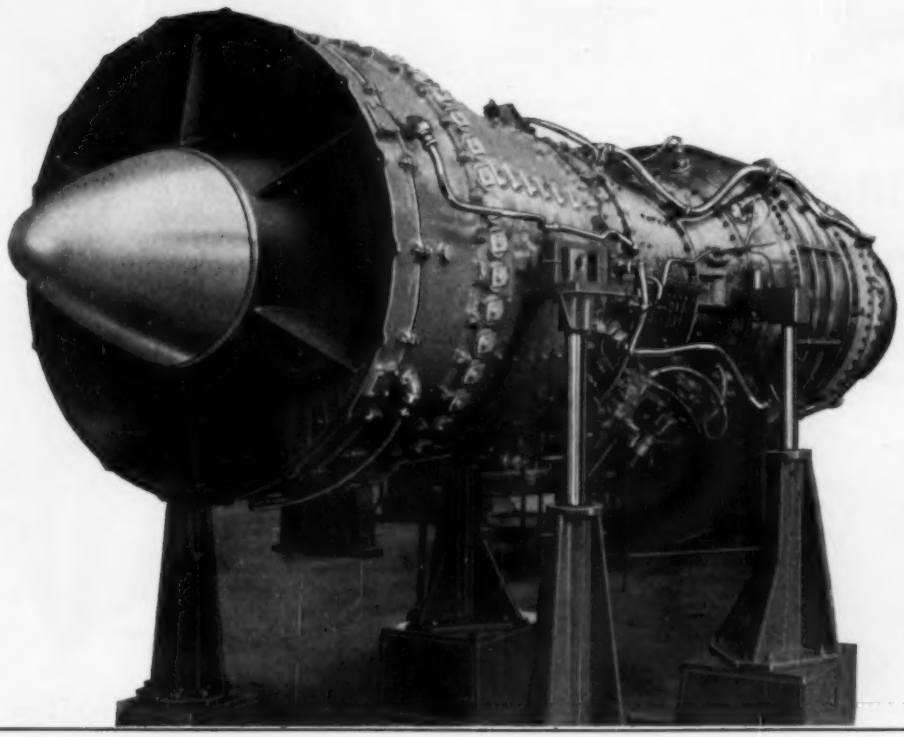

This gas turbine engine is in super-priority production for the Avro "Vulcan", the R.A.F.'s first delta-wing bomber. It is a twin-spool engine and is capable of great power at very high altitudes, demonstrated by its use in the English Electric "Canberra" which set a new world altitude record in May 1953. The highest thrust rating announced for the Olympus engine is 9,750 lb. and like all other British aircraft gas turbines it utilises Nimonic Alloys to combat creep, fatigue and high-temperature oxidation.

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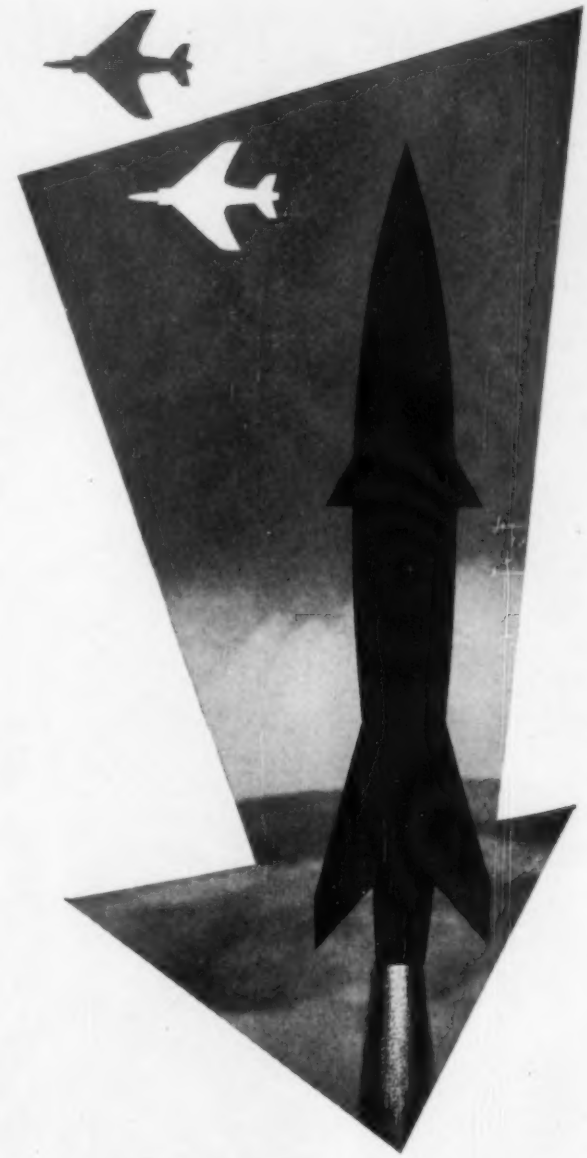

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CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

"Ambulance, Officer?"

THE paragraph which appeared under the above heading on page 764 of *Flight* for November 26th prompts me to write of a similar incident which took place recently at this school.

During the "shooting" of a scene for a training film, an ambulance was overturned, set on fire and casualties laid around on stretchers. The pilot of a helicopter engaged on a training flight in connection with a forthcoming Antarctic Expedition, on seeing this "accident," flew around and finally landed nearby with an offer to convey the "casualties" to Salisbury Infirmary!

I wish, through the medium of your journal, to thank this good Samaritan of the air for his generous thought towards these unfortunates.

Winterbourne Gunner, Wilts. J. STEWART, W/Cdr.
Joint School of Chemical Warfare.

Britannia Nomenclature

PERHAPS it is not too soon to consider the question of naming the Bristol Britannias destined for service with B.O.A.C. within the next year or so. May I suggest that each aircraft be named after a country or territory of the British Commonwealth?

There are, I feel, several points in favour of this suggestion. On the basis of its predicted performance, and bearing in mind the plans which B.O.A.C. have for it, the Britannia may be expected to do more than any previous aircraft to improve inter-Commonwealth communications. The policy suggested would produce a wide selection of words complementing the type-name Britannia, itself a most appropriate choice. The names would look and sound extremely attractive—e.g. R.M.A. *Canada*, *Kenya* or *Newfoundland*. Finally, such a gesture would surely be much appreciated by the countries concerned.

If airliners are to be named—and I firmly believe that they should be—it is certainly better to associate them with living ideas and enterprises than, for the sake of alliteration, to stereotype them with the unpronounceable titles of obscure deities.

Felixstowe, Suffolk. R. JAY.

Museum Show-pieces

WHILE expressing the greatest admiration for the achievements of the Wright Brothers in 1903 and Colonel Lindbergh in 1927 I should like to suggest that the caption to the illustration at the head of the article on "America's Air Museum" in your December 3rd issue contains a statement at least open to question: "Nowhere else in the world, it is said, can there be seen such an impressive sight as these two famous aircraft together."

Up to a few years ago the even more impressive sight of the original Wright Flyer and the Alcock and Brown transatlantic Vickers-Vimy machine of 1919 could be seen in the Science Museum. Now we have an exact replica of the Wright Flyer and beyond it the 1919 machine, the Supermarine machine that won the Schneider Trophy outright in 1931 and the Gloster/Whittle machine that flew successfully in 1940, using the W.1 engine exhibited below as a source of power.

There are those who might regard such a sequence as even more impressive, but we can only express pleasure at the news that our friends in Washington are within measurable distance of getting a building worthy of their fine collection. Readers of *Flight* may be interested to hear that there is now every expectation that the National Aeronautical Collections at the Science Museum may also be housed in their new permanent home in the extensions that are planned for completion in 1961.

London, S.W.7. W. O'DEA,
Keeper, Department of Aeronautics, Science Museum.

A Question of Nationality

I NOTICE, in your Editorial of November 19th, that you designate me as a "German aerodynamicist." May I point to the fact that I have been associated with Handley Page, Ltd., for over twenty-five years, and that I am a British subject?

If flag-waving should come in at all in aerodynamics, may I suggest at least to use the right flags? Although geographically the incident of my birth took place in Germany, I come from Austrian stock and held the black and yellow flag of Imperial Austria in my tiny fists when I was born.

However, I could hardly claim, for this reason, to be classed as "an Austrian aerodynamicist," in view of my long association with the British aircraft industry and my actual nationality.

In short, why bring flags in at all?

London, N.W.3. G. V. LACHMANN.

[Our reference was prompted, possibly subconsciously, by an association of ideas—namely, that Germany has produced some of the world's finest aerodynamicists.—ED.]

Wooden-frame Airship

I RECENTLY had the honour of being entertained by the Royal Air Force at a guest night at Hornchurch.

On entering the dining hall I noticed over the door a section of metal framework and, underneath on the plaque, the inscription that this was part of a Zeppelin shot down by William Leefe Robinson, V.C., on September 2nd, 1916.

Am I not correct in the statement that I made during the dinner that the airship shot down by Leefe Robinson on that occasion was in fact the Schutte-Lanz S.L.11, which was as far as I can remember of wood construction?

London, E.C.3. DEREK M. DENT.

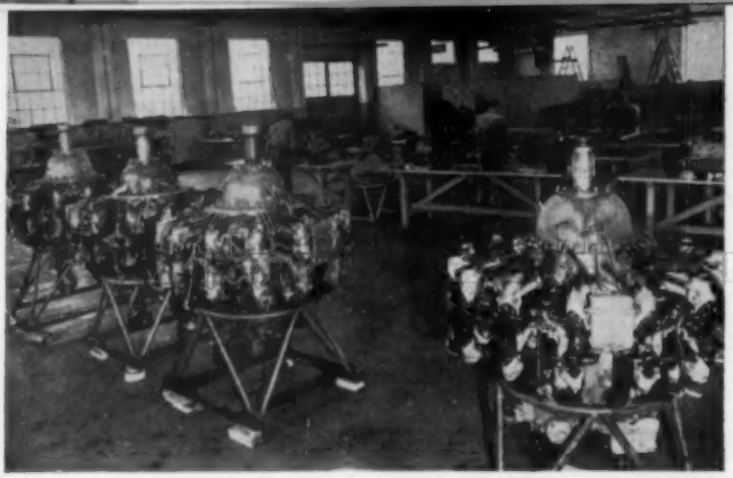
[Our correspondent was quite correct in his statements. It is understandable, however, that the inscription should have been inaccurate, for even Lt. Leefe Robinson's own report, as quoted in the official history, spoke throughout of "the Zeppelin."—Ed.]

FORTHCOMING EVENTS

Dec. 17. Institute of Navigation: "The Accuracy of Dead Reckoning in Air Navigation," by C. S. Durst, O.B.E.
Dec. 17. Institute of the Aeronautical Sciences: 18th Wright Brothers Lecture, by Bo Lundberg.
Dec. 18. British Interplanetary Society (North-west branch): "Debris in Space," by E. Burgess, F.R.A.S.
Dec. 18. British Interplanetary Society (provisional Yorkshire branch): "Living in Space," by M. S. Wright, B.Eng.
Dec. 20. Institute of the Aeronautical Sciences: 18th Wright Brothers Lecture (repeat), Los Angeles, U.S.A.
Dec. 20. Institute of Transport: Annual general meeting.
Dec. 21. R.Ae.S. Section Lecture: "Servo Tab Controls," by Dr. W. J. Strang, A.F.R.Ae.S.
Dec. 22. Institute of the Aeronautical Sciences: 18th Wright Brothers Lecture (repeat), Cleveland, U.S.A.
Dec. 29. British Institution of Radio Engineers: Discussion on "Education and Training of Radio Engineers."
Jan. 4. R.Ae.S. Section Lecture: "Recent Advances in the Knowledge of Transonic Airflow," by C. H. E. Warren, M.A., A.F.R.Ae.S.
Jan. 6. R.Ae.S. Main Lecture: Lecture to young people, by P. G. Masefield, M.A.(Eng.), F.I.A.S., F.R.Ae.S.
Jan. 8. British Interplanetary Society: "Using Hydrogen Peroxide," by A. V. Cleaver, F.R.Ae.S., and "Liquid Oxygen as a Rocket Propellant," by S. Allen, M.I.Mech.E., A.F.R.Ae.S.
Jan. 8. British Interplanetary Society (Midlands branch): "Spectroscopy in Astronautics," by W. H. T. Davison, M.A.
Jan. 14. Helicopter Association: Brains Trust.
Jan. 15. British Interplanetary Society (North-west branch): "High-Speed Flight," by R. J. Boor, A.M.C.T.
Jan. 15. Women's Engineering Society: New Year luncheon.
Jan. 24-28. Institute of the Aeronautical Sciences: 23rd Annual Meeting and Honors Night dinner, New York.
Feb. 1. Institute of Transport: Informal luncheon.
Feb. 5. British Interplanetary Society: "The Development of the Snarler Rocket Motor," by D. Hurden, B.A., Grad.I.Mech.E.
Feb. 11. Helicopter Association: "Development Experiences with the Bristol Type 173," by R. Hafner, F.R.Ae.S.
Feb. 14. Institute of Transport: Brancker Memorial Lecture: "Influence on Civil Aviation of Some Current Researches," by Sir Arnold Hall, F.R.S.
Feb. 16. Institute of Metals: Informal discussion on "The Treatment of Swarfs, Sawings and Residues in the Non-Ferrous Metal Industries" (at Birmingham University).
Feb. 23. Royal United Service Institution: "Rocket Propulsion and its Implications to Human Society," by A. V. Cleaver, F.R.Ae.S.
June 4-5. Royal Air Forces Association: Annual conference, Eastbourne.
June 10-19. Paris Aero Show.

R.Ae.S. Branch Fixtures (to Jan. 25):
Jan. 3, *Belfast*, "Model Making," by T. Gowan. Jan. 5, *Luton*, Junior Night. Jan. 6, *I.O.W.*, "Case for the Light Fighter," by P. A. Norman.
Jan. 11, *Boscombe Down*, "Domain of the Helicopter," by R. Hafner.
Jan. 12, *Manchester*, "Hydraulics," by E. J. Nicholl.
Jan. 20, *I.O.W.*, "Titanium," by Major P. L. Teed. Jan. 25, *Belfast*, "The Helicopter—Has it a Future?" by F. H. Robertson.

THE INDUSTRY



Part of the new engine overhaul shop of Air Engine Services (U.S.-U.K.), Ltd. (see news-item below). In the foreground are Pratt and Whitney R.1830 Twin Wasps awaiting overhaul: on the benches part-assembly of overhauled components is performed prior to final assembly.

"Flight" photograph

For Engine Overhaul

RECENTLY established by Air Engine Services (U.S.-U.K.), Ltd., is a new aircraft-engine overhaul shop at Blindley Heath, Surrey. The overhaul of Pratt and Whitney Wasps and Twin Wasps for British and foreign operators is the firm's particular interest at present, although an expansion of facilities to handle other types of engine is planned for the future.

The company itself is newly formed. Its chairman is W/C. D. W. Connor, D.F.C. (president of Global Aviation, Montreal), and Mr. J. Lester Pendleton (who is also director of Aeroservices, Ltd., and Aerotours (London), Ltd.), is executive director. Managing director is Mr. Ron Fox, previously assistant general manager of Field Aircraft Services, who has many years' experience of Pratt and Whitney engines and is in charge of operations at the Blindley Heath plant.

The main overhaul shop is housed in a modern factory with a single-span roof and an unobstructed floor area of some 10,000 sq ft. Adjacent is a second building which is being modified to provide office accommodation and also a stripping and cleaning bay, from which the stripped-down engines will pass to the main shop for inspection, replacement of parts where necessary, subassembly and final assembly. At present powerplants are received in the main shop: on the occasion of a recent visit the first engines to pass through the plant—eight R.1830 Twin Wasps for Saudi Arabian Airlines—were being overhauled.

Test facilities at the new plant include a Stromberg flow bench and test rig for carburettors, and a Magnaflux crack detector; further equipment is being installed. Considerable stocks of R.1830 and R.1340 spare parts are held, and A.R.B. overhaul approval has been obtained. In the course of the first year of operation, the number of staff at Blindley Heath is expected to increase from the present 20 to about 75, and an output rate of five engines per week is anticipated. Ultimately, the company's aim is to sell engine flying hours to operators.

A recent visitor to the plant was the chief European technical representative of the Pratt and Whitney company, who is reported to have been favourably impressed with the facilities.

Dowtys Miss an A.G.M.

IN his report to shareholders this year, Mr. G. H. Dowty, chairman of the Dowty Group, begins by saying: "This must be a most peculiar year to our shareholders—it will be a year without an annual general meeting. The shares formerly held in Dowty Equipment, Ltd., were exchanged . . . into shares of Dowty Group, Ltd.—a holding company which came into being only this year, and its first accounts will be made up to March 31st, 1955."

Mr. Dowty went on to say that the year under review (ended March 31st, 1954) had been one in which a profit of a record-breaking seven figures had been achieved. In the past six years the group had opened no fewer than seven new plants. The Canadian company in particular had continued to progress; orders on hand represented two-and-a-half years' work at the present rate of turnover, and further factory extensions were taking place.

In his financial statement, the chairman showed that the seven-figure profit was £1,115,957, an increase of £252,876 over the previous year. Tax at £704,537 showed an increase of £121,741, but this included £116,797 for the Excess Profits Levy which ceased to be chargeable after December 31st, 1953. During the two years of its operation, says Mr. Dowty, "this so-called Excess Profits Levy" cost the group about a quarter of a million pounds.

Equipment Compendium

ONCE again a new edition of the *Dunlop Aviation Equipment Manual* has appeared; each year this publication seems to excel itself in attractiveness of format and comprehensiveness of technical information.

This year's edition is printed in no fewer than fourteen different colours, each colour denoting a separate section. Totalling 146 large pages, these sections deal first with typical Dunlop-equipped aircraft and then with tyres, wheels, brakes, brake control systems, pneumatic actuating systems, flexible pipes, windscreen wipers, armament controls, guided-missile equipment (represented by a spherical air-bottle and a solenoid-operated valve, though much other equipment is applicable), de-icing systems, rubber accessories, and servicing apparatus and facilities.

IN BRIEF

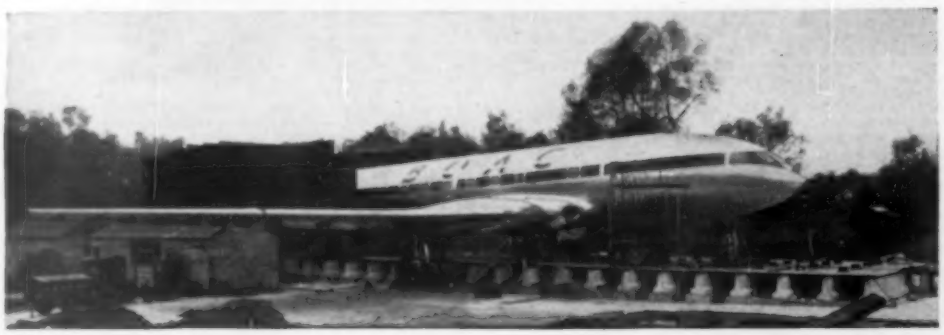
A. Cdre. F. R. Banks, C.B., O.B.E., of the Bristol Aeroplane Co., Ltd., has been appointed a director of Rotol, Ltd., in place of Dr. A. E. Russell (also of Bristols), who has resigned. Mr. R. J. Raff has been appointed secretary of both Rotol, Ltd., and British Messier, Ltd.; and Mr. J. C. Bracher has been appointed chief accountant of these two firms.

* * *

Silentbloc, Ltd., manufacturers of flexible bearings and anti-vibration devices, are shortly moving from their Notting Hill Gate, London, premises to a new factory in Sussex. After December 20th all correspondence should be addressed to them at Manor Royal, Crawley, Sussex.

* * *

In the caption to a photograph (p. 822, December 3rd) of Mr. D. E. Ayres of Aerocontacts, Ltd., it should have been made clear that he had been responsible for developing the ground-equipment side of the company's "Scoba" division; the building-up of the "Scoba" range of equipment in general has been the responsibility of Mr. M. H. Nicholas, who continues this work as manager of the division.



COMET G-ALYU at Farnborough during erection of the testing tank built for the R.A.E. investigation. The reinforced concrete units beneath the floor—174 of them—were moulded at short notice by Marley Concrete Products of Peasmarsh, near Guildford. This official photograph was one of several sent to the firm by the R.A.E. "as a small token of our appreciation of your efforts."

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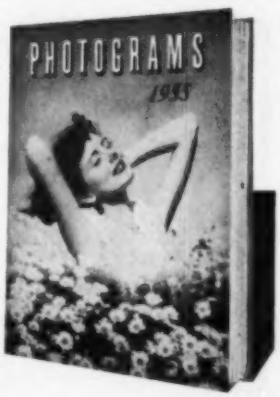

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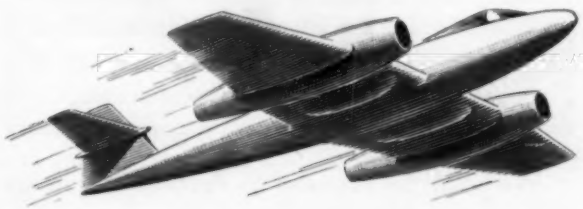

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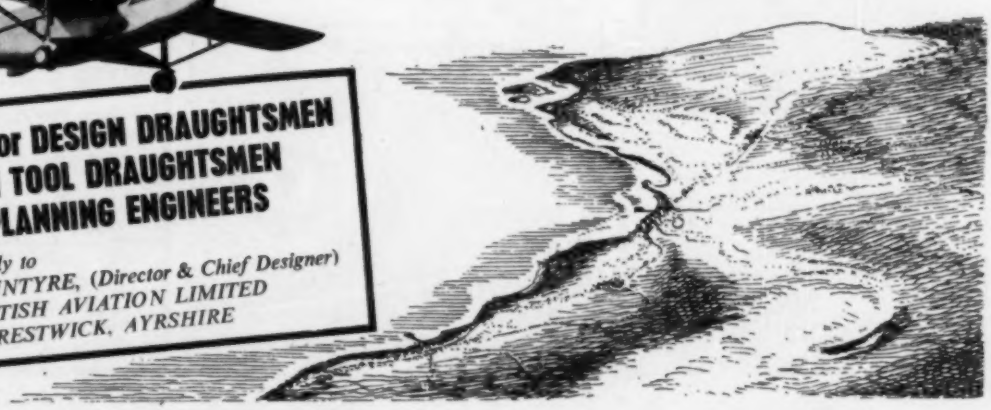

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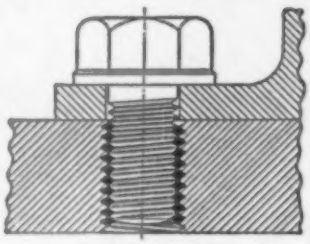

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EXPORT PACKING SERVICE, LTD., Imperial Buildings, 56 Kingsway, W.C.2. Tel.: Chancery 5121-3. Scientific packers to the Services and industry. Specialists in the packing of aircraft and aircraft components. Approved packers for the Admiralty, A.I.D., I.F.V., C.I.A., C.I.S., I.E.M.S., M.o.S. and many foreign Government Departments. [0920

PATENTS

THE proprietor of British Patent No. 660854, entitled Improvements in Stall Warning Device for Airplanes, offers same for licence or otherwise to ensure its practical working in Great Britain. Inquiries to Singer, Stern & Carlberg, Chrysler Building, New York 17, N.Y., U.S.A. [2996

PATENTS

THE Office National d'Etudes et de Recherches Aéronautiques, 55 Bd Malesherbes, Paris, France, holder of British Patents No. 691,294, dated May 13, 1953, "Improvements in Signalling Systems," No. 697,311, dated September 23rd, 1953, "Improvements in or relating to automatic level control arrangements applied to systems of distance measurement," No. 690,028 dated April 8th, 1953, "Improved System for Guiding Dirigible craft, particularly aircraft," No. 698,800 dated October 21st, 1953, "Improvements in or relating to devices for directly measuring and instantaneously recording the angular displacements of a body," No. 691,524, dated May 13th, 1953, "Improvements in automatic guiding systems for aircraft and other moving bodies," No. 688,374, dated March 4th, 1953, "Improvements in or relating to dielectric antennae," should like to deal with constructors in Great Britain through licensing. [3013

PHOTOGRAPHY

AIRCRAFT cameras K20, K24, F24, F52, etc. We have large stocks equipment, including controls, mounts, lenses and processing tanks, film.
HARRINGAY PHOTO SUPPLIES (F.M.), 423 Green Lanes, N.4. MOU. 2054. [2942
AMERICAN and British aircraft cameras; large stocks of latest models available, including F24, F52, K8a, K20, K24 and G45, etc. Also spare parts, lenses, films, equipment, etc. Inquiries will receive immediate attention.
DIRECT PHOTOGRAPHIC SUPPLY CO., 2 Harrow Road (Cnr.), Edgware Road, London, W.2. Tel.: PADdington 7581. [0563

PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:—
APPLICATION No. 429. From B.K.S. Air Transport, Ltd., of 1 Marylebone High Street, London, W.1, for a Seasonal Inclusive Tour service, with Dakota and/or Viking aircraft, in conjunction with Lep Travel, for the carriage of passengers and supplementary freight, between Southend and Biarritz (for San Sebastian), at a frequency of from one to three services weekly during the season from April to October inclusive each year, for a period of seven years commencing 1st May, 1955.

(*Continued at top of column 2*)

PUBLIC ANNOUNCEMENTS

(*Continued from column 1*)

APPLICATION No. 430. From Airwork, Ltd., of 15 Chesterfield Street, London, W.1, for an all-freight service with Bristol 170 aircraft, for the carriage of freight between Stranraer (West Freugh) and Belfast (Nutts Corner) at a frequency of from one to ten services daily for a period of 10 years, commencing three months from date of approval.
APPLICATION No. 431. From Air Kruise (Kent), Ltd., of Lympne Airport, Lympne, Kent, for a Seasonal Inclusive Tour service with Dakota aircraft, in conjunction with Lumb's Continental Tours, for the carriage of passengers between Ferryfield and Lyons (Bron), at a frequency of from one to two services weekly during the season from April to October inclusive each year, for a period of seven years, commencing 1st April, 1955.
THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections.
THE Air Transport Advisory Council also give notice that the following application has now been withdrawn:—
APPLICATION No. 418. From British European Airways Corporation, of Keyline House, Ruislip, Middlesex, for permission to combine, as necessary, their all-freight services on the routes set out as Routes Nos. 3 and 8 in Schedule "B," Part II, of the Council's Terms of Reference, and also to omit traffic stops at Rome and Athens on the combined route, which was advertised in "The Times," "The Aeroplane" and "Flight" on 26th November, 1954. [3023

TUITION

FREE! Brochure giving full details of courses, in all branches aero eng. covering A.F.R.Ae.S., A.R.B. Certs., M.C.A. exams, etc. We are the only postal training college operated by an industrial organization. —Write to E.M.I. Institutes, London, W.4. [0964

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AVIGATION can help and advise you if you want a Civil licence. We can offer classroom and postal tuition for all Pilot/Navigator licences. Instruction for A.R.B. Technical and Link training with full briefing for I.R. test. Lesson material presented with multi-colour illustration to simplify study; postal students receive personal marking service.
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INSTRUMENT FLYING
TWIN CONVERSIONS
EVERY facility at reasonable rates from:—
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A.F.R.Ae.S., A.R.B., Certs., A.M.I.Mech.E., etc., on "no pass, no fee" terms; over 95 per cent. successes. For details of exams and courses in all branches of aeronautical work, navigation, mechanical eng., write for 144-page handbook free.—B.I.E.T. (Dept. 702), 29 Wright's Lane, London, W.8. [0707
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FOR details of these and other courses, apply to—the Commandant, Air Service Training, Ltd., Hamble, Southampton. [0970

D. NAPIER & SON LTD.

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An increasing number of attractive posts are available working upon rapidly advancing programmes of technical development, covering a wide range of engineering projects in the aeronautical field. Requirements are:—

Senior Posts. Degree or Higher National Certificate standard in engineering or applied science together with some research or development experience (preferably aircraft) in the same or allied field.

Junior Posts, Rather less qualifications but with sound technical background.

Keenness, intelligence, and strong interest in aircraft, aircraft engines, and the newest forms of propulsion motors will form the basis for an expanding career to suitably qualified young men, with commensurate salaries. Service experience an advantage if allied to technical ability.

Applicants should write with fullest possible particulars quoting this advertisement so that consideration can be given to placing in the most suitable vacancies, to

Dept. C.P.S., 336/7 Strand, W.C.2, quoting Ref. 1368.

GLOSTER AIRCRAFT CO. LTD.

GLOUCESTER

HAVE VACANCIES ON SUPER-PRIORITY DESIGN AND DEVELOPMENT PROJECTS

FOR

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DESIGN DRAUGHTSMEN

(SENIOR & JUNIOR)

Consideration will also be given to Draughtsmen with Mechanical, Structural or Electrical experience.

Also

STRESSMEN

(SENIOR & INTERMEDIATE)

for both strength and flutter calculations.

The conditions of employment are good with progressive salary, good sports and welfare facilities, pension scheme, etc.

APPLICATIONS STATING AGE, PREVIOUS EXPERIENCE AND EMPLOYERS SHOULD BE ADDRESSED TO THE

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BROOKLANDS AVIATION LTD.

NORTHAMPTON

REQUIRE

PRODUCTION ENGINEER

Experience on repair of Service aircraft essential. Good salary commensurate with ability and experience.

APPLY TO:

Brooklands Aviation Ltd.,
Buttocks Booth, Moulton,
Northampton.

SENIOR DRAUGHTSMEN

required for

AERO ENGINE INSTALLATION

work. Some experience of airframe design is desirable. Good salaries and prospects to suitable applicants. The work is of an interesting nature and of high priority. Superannuation scheme. Arrangements made for interviews to take place locally and on Saturday mornings if necessary. Please write in confidence, giving full details of experience, education and qualifications to:—

The Personnel Officer,
The de Havilland Engine Co., Ltd.,
Stag Lane, Edgware, Middlesex.

HAWKER AIRCRAFT LIMITED

CANBURY PARK ROAD, KINGSTON-on-THAMES

Applications invited for following positions

JIG & TOOL DRAUGHTSMEN

Applicants must be fully experienced on modern techniques

AIRCRAFT PROCESS ENGINEERS

Applicants must have at least five years practical aircraft experience, and be conversant with all modern manufacturing methods

Superannuation and all facilities

Please write fully to Personnel Officer

TUITION

LEARN to fly for £26. Instructors' licences and instrument flying for £3/5/- per hour. Night flying £4/5/- per hour. Residence 5 gns. weekly. Approved M.C.A. private pilot's licence course. Specialized course for junior commercial pilot's licence. —Wiltshire School of Flying, Ltd., Thruxton Aerodrome, nr. Andover, Hants. Tel.: Weyhill 352. [0253

AERONAUTICAL. Comprehenhive full-time technical and practical training for careers in all branches of aviation engineering. Diploma course leads to interesting executive appointments in civil aviation design and development, draughtsmanship, maintenance, etc. Extended courses to prepare for A.F.R.Ae.S. and A.M.I.Mech.E. examinations.—Write for prospectus to Senior Master, College of Aeronautical Engineering, Chelsea, London, S.W.3. Flaxman 0021. [0019

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order 1952.

THE ENGLISH ELECTRIC CO., LTD.,

Luton

Have the following vacancies in their Drawing Offices at Luton and Stevenage:—

Designer Draughtsman

for Design and Layout of high efficiency light alloy structures. Good knowledge of materials and manufacturing techniques essential. Reference D.1.

Detail Draughtsman

for light mechanical work associated with aircraft structures and installation of special components. Knowledge of electrical or hydraulic systems an advantage. Reference D.2.

Designer Draughtsman

for layout of radar and electronic equipment to be used in ground or airborne installations. Experience of miniaturization or potting techniques a useful asset. Reference D.4.

Designer Draughtsman

for layout of Electronic Equipment employed in Laboratory Measurements and Monitoring. Previous experience of RCS 1000 very desirable. Reference D.5.

Detail Draughtsman

for general work on Electronic and Electro-Mechanical Components. Previous experience in assembly, manufacture or testing similar equipment a great advantage. Reference D.6.

Draughtsman or Woman

for preparation of Circuit or Wiring Diagrams relating to construction or installation of Electronic or Electro-Mechanical Equipment. Training can be given to persons with Circuit knowledge but lacking drawing experience. Reference D.7.

These positions carry good prospects and attractive salaries, and are pensionable after qualifying period. Housing assistance available for some posts. Applications to Dept. C.P.S., 336/7 Strand, W.C.2., quoting Ref. 1119J. [2971

AIRCRAFT STRUCTURAL ENGINEERS

TWO senior men with good qualifications are required for interesting structural design work mainly concerned with high speed projects. These are senior appointments and only men with the following should apply:—

FOR post (a)—good academic qualifications, wide experience in detail design and stress analysis, knowledge of modern workshop processes, ability to lead a group.

FOR post (b)—high academic qualifications, experience in research on new forms of construction and methods of stress analysis and a capacity for supervision.

ATTRACTIVE salaries will be paid to the men finally selected and suitable unfurnished accommodation will be made available soon after the commencement of employment.

WRITE, giving details of age, experience, qualifications, etc., to Box 3J. M 3091 A. K. Advg., 212a, Shaftesbury Avenue, London, W.C.2. [3001

H. M. HOBSON, LTD., invite applications for positions in the drawing office as follows: designers, detail and modification draughtsmen, checkers, stressmen. The work is concerned with interesting projects connected with fuel metering equipment and hydraulic flying controls for aircraft.—Hobson Works, Fordhouses, Wolverhampton. [0420

FERRANTI LIMITED

EDINBURGH

Flight Trials Division

APPLICATIONS ARE INVITED FOR **ELECTRONIC ENGINEER** for interesting work in their Flight Trials division. The engineer will be engaged on trials to evaluate the technical and operational performance of fire control and navigational systems, air and ground. The qualifications required are to degree or equivalent standard with a minimum of three years' experience. Ref. No. 29/EE/TID.

RADAR MAINTENANCE ENGINEER who will be responsible for a small outstation. Duties will involve limited travelling in the U.K. Ref. No. 29/RME/TID.

Ex Radar Officers and Senior N.C.O.s are invited to apply for either or both vacancies. The appointments are pensionable and offer excellent prospects and working conditions in or attached to our new laboratories.

Apply for an application form, quoting appropriate reference number to the Personnel Officer, Ferranti Limited, Ferry Road, Edinburgh 5.

THE WIND TUNNEL DEPARTMENT OF SHORT BROTHERS & HARLAND LIMITED

has vacancies for

TECHNICAL ASSISTANTS

for experimental work in the Low Speed and High Speed Tunnels. The latter will be in use early next year and there will be considerable scope for original work, particularly in the field of instrumentation.

Previous experience in Wind Tunnel work or knowledge of Aerodynamics is not essential.

Qualifications: University Degree or H.N.C. in Engineering.

Pay, conditions and prospects attractive. Assistance with housing and with removal expenses.

Applications, with particulars, to:—

Staff Appointments Officer,
P.O. Box No. 241, Belfast,
quoting Ref. S.A.21.

WESTERN MANUFACTURING (READING) LIMITED

In our expanding Research Department vacancies are continually arising for

DEVELOPMENT ENGINEERS
SENIOR AND JUNIOR DESIGNERS
AND DRAUGHTSMEN

Applications are invited from personnel experienced in the design and development of electro-mechanical aircraft equipment, and should be submitted to the

Personnel Manager,
Western Manufacturing (Reading) Ltd.,
The Aerodrome,
Woodley, Reading, Berks.

SITUATIONS VACANT

HAWKER AIRCRAFT, LTD.,

Kingston-upon-Thames, Surrey.

APPLICATIONS are invited for important pensionable staff positions offering good commencing salaries and opportunities for advancement in the design, research and development and experimental departments:

Senior Electrical Engineers

A GOOD degree is necessary with wide and sound experience in electrical and/or electronic engineering.

Senior Technicians

GOOD degree in aeronautical or mechanical engineering with sound previous experience in aircraft or light engineering.

Technical Assistants

APPLICANTS should have, if not an aeronautical or mechanical engineering degree, at least the Higher National Certificate with good experience in the aircraft industry.

Senior Design Draughtsmen

AT least Higher National Certificate in electrical or mechanical engineering.

PLEASE write fully stating the type of work in which interested and salary expected, to

The Personnel Supervisor,
HAWKER AIRCRAFT LIMITED,
Canbury Park Road,
Kingston-on-Thames. [3017

VICKERS-ARMSTRONGS, LIMITED

now in Production of Super-priority Aircraft

require:

Draughtsmen (Senior and Junior)

preferably with aircraft experience. Men with mechanical, structural and electrical drawing experience also considered.

Jig and Tool Draughtsmen

for designing machine fixtures, assembly tools and jigs.

Aircraft Planners
Ratefixers
Estimators

and

Inspectors.

Write giving full particulars including age and salary required for Personnel Dept., South Marston Works, Swindon, Wilts. [2952

SENIOR INSTALLATION DESIGN

DRAUGHTSMEN

are required at

SUPERMARINE DIVISION

of

VICKERS-ARMSTRONGS, LTD.

for

ELECTRICAL, electronic and/or radio, radar aircraft work. Excellent positions for the right men able and willing to take responsibility, show initiative and follow the job through.

THE first requirement is for men with similar aircraft experience, but applicants will be welcomed from others who have experience in the electrical or radio industry associated with aircraft and the like.

FULL details stating age, salary, etc., to

Personnel Dept.,
VICKERS-ARMSTRONGS, LTD.,
Supermarine Works,
Hursley Park,
Nr. Winchester. [2995

DRAUGHTSMEN

STRESSMEN

AERODYNAMICISTS

SAUNDERS-ROE LIMITED have vacancies for junior aerodynamicists and all grades of draughtsmen and stressmen.

ANYONE wishing to be considered is invited to write in detail, or send a postcard for an application form, to the Personnel Officer at the address below.

HOUSING facilities, pension and staff assurance schemes, sports and social club, canteens, congenial surroundings.

SAUNDERS-ROE LIMITED (Ref. P/16), East Cowes, Isle of Wight. [2904

THE FAIREY AVIATION COMPANY LIMITED

HEATON CHAPEL, STOCKPORT

require

STRESSMEN

with Degree or H.N.C., and not less than three years experience in Aircraft Industry

also

SENIOR and INTERMEDIATE DRAUGHTSMEN

Aircraft experience desirable.

Write, stating age and experience etc., to:—

The Employment Manager,
Heaton Chapel Works,
Stockport

MARSHALLS' AIRPORT WORKS

CAMBRIDGE

Vacancies at Cambridge and "On Site"

SKILLED AIRCRAFT ELECTRICIANS

SKILLED AIRFRAME FITTERS

At Cambridge only

SPRAYERS FOR SYNTHETIC OR CELLULOSE WORK

We are at present engaged on a variety of modern Service and Civilian Aircraft.

Accepted applicants will be paid subsistence allowances if maintaining a home outside the Cambridge area. Comfortable hostel accommodation (single or double cubicle) with good food available at works. Alternatively private lodgings on nearby housing estate adjoining City bus route.

Generous subsistence and other allowances whilst "on site."

Applications in first instance to:—

Employment Officer, Airport Works,
Newmarket Road, Cambridge.
Phone 56291. Ext. 36

THE BRISTOL AEROPLANE COMPANY LIMITED

requires:—

JIG & TOOL DRAUGHTSMEN

for work on highly important new projects.

Pension scheme, salaries and prospects of promotion on merit are excellent.

Applications, quoting E.D.23, giving details of experience, age and qualifications should be addressed to the

Personnel Manager,
The Bristol Aeroplane Co., Ltd.,
Engine Division, Filton House, Bristol.

AIRCRAFT SPRING WASHERS

TO B.S. SPECIFICATION S.P.47

CROSS MFG. CO. (1938) LTD., COMBE DOWN, BATH

SITUATIONS VACANT

THE ENGLISH ELECTRIC CO.'S

GUIDED WEAPONS DIVISION

have vacancies at

Luton

for

SENIOR ENGINEER INSPECTORS

THE work will require close liaison with flight trials and design engineers and may involve participation in trials away from base.

APPLICANTS should have H.N.C. (Electrical) or equivalent qualifications and have several years' experience covering two or more of the following:—

(1) Electronics (D.C. amplifiers, pulse circuits or microwaves).
(2) Gyros.
(3) Hydraulics.
(4) Servo systems.

THESE are senior appointments carrying attractive salaries and are pensionable after qualifying period. Housing assistance can be given to successful applicants normally resident in the Greater London Area. Applications to Dept. C.P.S., 336/7, Strand, W.C.2, quoting Ref. 1355E. [3002

THE MULLARD RADIO VALVE CO., LTD.,

has a number of vacancies for

TECHNICAL ASSISTANTS

in its production and development departments at its Mitcham factory.

APPLICATIONS are invited particularly from persons holding the General Certificate in education at "O" level, in science subjects advanced level, Ordinary and Higher National Certificate in Engineering.

THE posts provide for further training in specialized electronics and there are facilities for further study. There are considerable opportunities for promotion in varying expanding fields of electronic work.

COMMENCING salaries are according to age, experience and qualifications and can be considered as progressive. There is a company pension scheme and long service holiday plan.

APPLICATIONS in writing which will be treated with the strictest confidence should be addressed to The Personnel Officer,

THE MULLARD RADIO VALVE CO., LTD.,
New Road,
Mitcham Junction, Surrey,
quoting reference JFG/GEN. [3012

SENIOR STRESSMAN

WANTED IMMEDIATELY

by well known

Engineering Company

in

London

APPLICANTS should have wide experience of aero gas turbines and must be capable of producing suitable mathematical treatments for new problems as they arise.

DEGREE in mechanical engineering essential. Prospect of promotion to control a team for a suitable candidate. Please apply in strict confidence to Box 0605. [3020

ELLIOTT BROTHERS (LONDON) LIMITED

CONTRACTS MANAGER

is required for the

AVIATION DIVISION

of the above Company

KNOWLEDGE of Air Ministry contracts procedure and costing and estimating systems together with experience of all aspects of factory routine is essential. Preference will be given to men with engineering qualifications and background and the ability to complete negotiations at an executive level.

APPLICATIONS giving full particulars of age, experience, qualifications and stating salary required to:—

PERSONNEL Officer, Century Works, Lewisham, S.E.13. [2935

AIRCRAFT VIBRATION ENGINEERS

MALE or female engineers, having a good mathematical background, are invited to apply for intermediate appointments in a section engaged on flutter and vibration analysis on modern high speed aircraft.

WRITE stating age, experience, etc., or send P.C. for application form, to the Personnel Department (Ref: P/18), Saunders-Roe Limited, East Cowes, I.O.W. [3000

SITUATIONS VACANT

FERRY AIRPORTS LIMITED

THE following vacancies occur at our maintenance base at Blackbushe:
(a) Skilled air frame fitters, experience on Bristol Freighters and Hermes aircraft essential.
(b) Skilled engine fitters with experience on Bristol Hercules engines.
(c) Skilled electricians, experience on Hermes aircraft preferred.
(d) Instrument makers, skilled overhaul and repair.
(e) Radio mechanics, skilled repair and maintenance.
GOOD rate and conditions on interesting work. Application should be made to Personnel Office, Ferry Airports Limited, Blackbushe Airport, Camberley, Surrey. [2984

AIRCRAFT Design.
IF you have technical experience in Project Design work, we should be very pleased to hear from you.
WE can offer interesting work in a specialist group and are prepared to assist with accommodation.
DETAILS of age, qualifications and experience should be sent to Box 3J M 2504, A.K. Advg., 212a, Shaftesbury Avenue, London, W.C.2. [2970

ROCKET Experimental Division.
(1) A young energetic man with a degree or Higher National Certificate is required to work on the design of test rigs and provision of all equipment needed for testing rocket engines.
(2) Vacancies exist for two men with degree or Higher National Certificate in Mechanical Engineering to work on the development of complete rocket engines.
APPLY to Reference CG/RD4, Technical Personnel Manager, Armstrong Siddeley Motors, Coventry. (Please state which section of the advertisement you are interested in.) [2947

HYDRODYNAMIC Research and Development.
STAFF urgently required for Design and Model Experimental work (including towing tank testing) on ship and aircraft projects.
TECHNICAL experience in an associated field, e.g., fluid motion or naval architecture, or the possession of a Higher National Certificate would be an advantage.
ASSISTANCE with accommodation will be provided.
WRITE to Box 3J M 2509, A.K. Advg., 212a, Shaftesbury Avenue, London, W.C.2. [2969

REQUIRED for service in Middle East Area.
(1) Pilots—minimum qualification commercial licence with instrument rating.
(2) Engineers—"A" and "C" or single licences for one or more of the following airframes/engines: Dakota, Dove, Rapide, P. & W. R.1830, Queen II, Queen 70.
(3) Engineers—"X" electrical/instruments licence.
(4) Aircraft and engine fitters with experience of Dakota and/or Dove, P. & W. R.1830, Queen 70.
WRITE to: Airwork Limited, Overseas Division, Sutton Lane, Langley, Slough, Bucks. [3006

AERONAUTICAL Engineers required, age 25/35.
H.N.C. or degree standard necessary. Good works experience preferable with apprenticeship on aircraft engines. Knowledge of inspection and test procedures essential.
VACANCY in North Midland area where duties primarily concerned with type and modification approval and operational development.
VACANCY in London area where duties primarily concerned with engine performance and type approval.
PERMANENT position. Salary—according to qualifications and experience. Superannuation scheme in force. Box 0600. [3018
ONE "D" Licence engineer required with experience on light aircraft engines.
APPLY, Chief Engineer, Derby Aviation, Ltd., Derby Airport, Derby. [3007
CHIEF inspector required, fully conversant with A.I.D. and A.R.B. procedure. Also
DRAUGHTSMAN for aircraft testing and ground equipment. Apply giving details of experience to Rollasons, Croydon Airport. Tel. CRO 5151. [2978
LICENSED flight radio operators required. Apply Dan-Air Services, Ltd., 36/38, New Broad St., London, E.C.2. Phone London Wall 5911. [3004
FLIGHT engineers licensed A and C on York and Merlin immediate vacancies. Write Dan-Air Services, Ltd., 36/38 New Broad St., London, E.C.2. Phone London Wall 5911. [3003
SENIOR and junior draughtsmen required for interesting work on remote control for aircraft and atomic equipment.—Apply in writing to Teleflex Products, Ltd., High Road, Chadwell Heath, Essex. [0720

FERRY Airports Limited have immediate vacancies for airframe, engine and electrical inspectors preferably licensed or experienced on Hermes or Bristol 170 aircraft. Please apply Personnel Office, Ferry Airports Ltd., Blackbushe Airport, Camberley. [3021

INTEGRAL LIMITED, Birmingham Road, Wolverhampton, invite applications for vacancies on the design and development staff, the work is on interesting new projects concerning aircraft hydraulic mechanisms. Experience in aircraft component design testing and good technical qualifications are desirable.
WILL applicants please state age, qualifications, experience and salary required. [2914

DRAUGHTSMEN. Owing to an extensive development programme, Ruston & Hornsby, Ltd., require additional draughtsmen immediately
DESIGNER draughtsman experienced with fuel injection equipment and capable of carrying out hydro-dynamic calculations.
DESIGNER draughtsman experienced in medium speed diesel engine design, suitable for industrial and marine application.
DRAUGHTSMEN experienced in high and medium speed diesel engine installation work, suitable for industrial and marine application.
DRAUGHTSMAN experienced in diesel loco design, but first-class experience is not essential with regard to the engine and gearbox unit.
DRAUGHTSMEN experienced in high speed diesel engine design and also their application to transportable and mobile installation.
JUNIOR draughtsman required for detail work in connection with high speed engines and their application to transportable and mobile units.
DRAUGHTSMAN experienced in design of gearbox units applicable to marine and loco installations.
AGE 24 and upwards. Salaries £550-£750 p.a. according to age and qualifications. Posts pensionable at 25 years of age and over. Applications giving age, qualifications and experience, and stating first preference; and senior applications giving first and second preference to Employment Manager, Ruston & Hornsby, Ltd., Lincoln. [2990
DESIGNER required by company manufacturing high pressure reducing valves and special equipment. Sound knowledge of hydraulics and pneumatics, preferably with design experience. Excellent salary and prospects.—Write stating age, experience, qualifications. Box 0538. [2998
FLYING instructors, one full- and two part-time, required by Derby Aviation, Ltd., for duties with Elstree Flying Club. Interesting work includes night and instrument flying, twin-conversion training, etc. Conscientious and enthusiastic men only, should apply to Chief Instructor, Elstree Aerodrome, Herts. [3009
CHIEF stressman is required by Normalair, Ltd., to be responsible for strength calculations in connection with aircraft pressurizing and air conditioning equipment, including cold air units and high altitude breathing equipment, and other new projects. An engineering degree or equivalent is essential.
APPLICATIONS, stating age, experience, qualifications and salary required, are to be addressed in the first instance to the Personnel Officer, Normalair, Ltd., Yeovil. [0347

THE HELICOPTER DIVISION
OF
SAUNDERS-ROE LTD.
at SOUTHAMPTON AIRPORT

are enlarging their Design Team and invite applications for the following vacancies:—

1. SENIOR TECHNICIAN
This post carries considerable responsibility and requires a knowledge of helicopter aerodynamics and vibration problems. A Degree is essential, preferably with Honours.

2. SENIOR STRESSMAN
Preferably with a Degree and at least four years experience in aircraft stressing. Helicopter experience would be an advantage.

3. TECHNICIANS
Technicians are required for work on helicopter aerodynamics, performance and vibration analysis and for project investigations. A Degree or H.N.C. is a requirement.

4. INTERMEDIATE STRESSMAN
With experience in aircraft stressing. A University Degree or H.N.C. is desirable.

5. PROJECT DRAUGHTSMAN
Experience in aircraft project design would be an advantage.

6. ELECTRICAL DRAUGHTSMAN
To take full responsibility for electrical installation work in the Division.

Salaries will be commensurate with age and experience. Please apply to:—
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MECHANICAL engineers required by Ministry of Supply at Armament Research and Development Establishment near Sevenoaks, Kent; Fighting Vehicles Research and Development Establishment near Chertsey, Surrey; National Gas Turbine Establishment near Farnborough, Hants; Aeroplane and Armament Establishment, Amesbury, Wilts; Royal Aircraft Establishment, Farnborough, Hants, and outstations. Work concerned with research, design and development of a wide range of civil and military equipment including aircraft, armaments, fighting vehicles, gas turbines, guided weapons, rockets and accessories. Appointments according to qualifications, age and experience connected with appropriate research or development. Scientific officers (1st or 2nd class hons. graduates). Salary £445-£815; experimental officers and assistant experimental officers (Higher School Certificate (Science) or equivalent—degree or H.N.C. may be an advantage). Salary E. O. (Min. age 26) £690-£850; A.E.O. £276 (age 18)-£615. Women somewhat less. F.S.S.U. benefits may be available for S.O. class. Application forms from M.L.N.S., Technical & Scientific Register (K), 26 King Street, London, S.W.1, quoting C 805/54A. [3005

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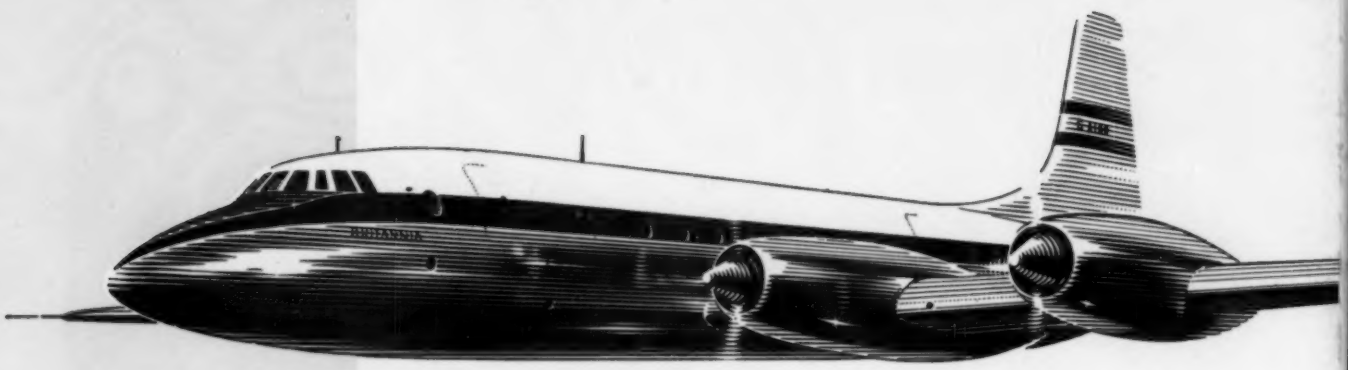

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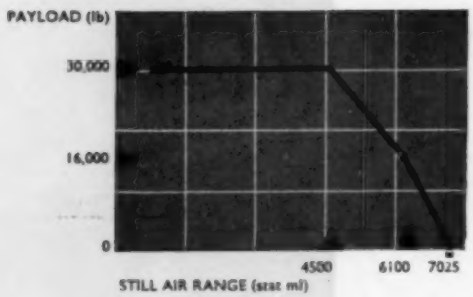

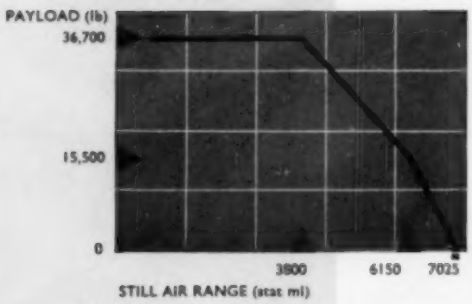

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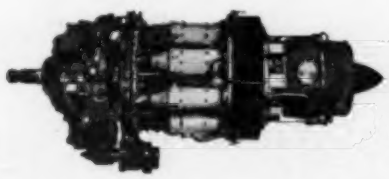

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